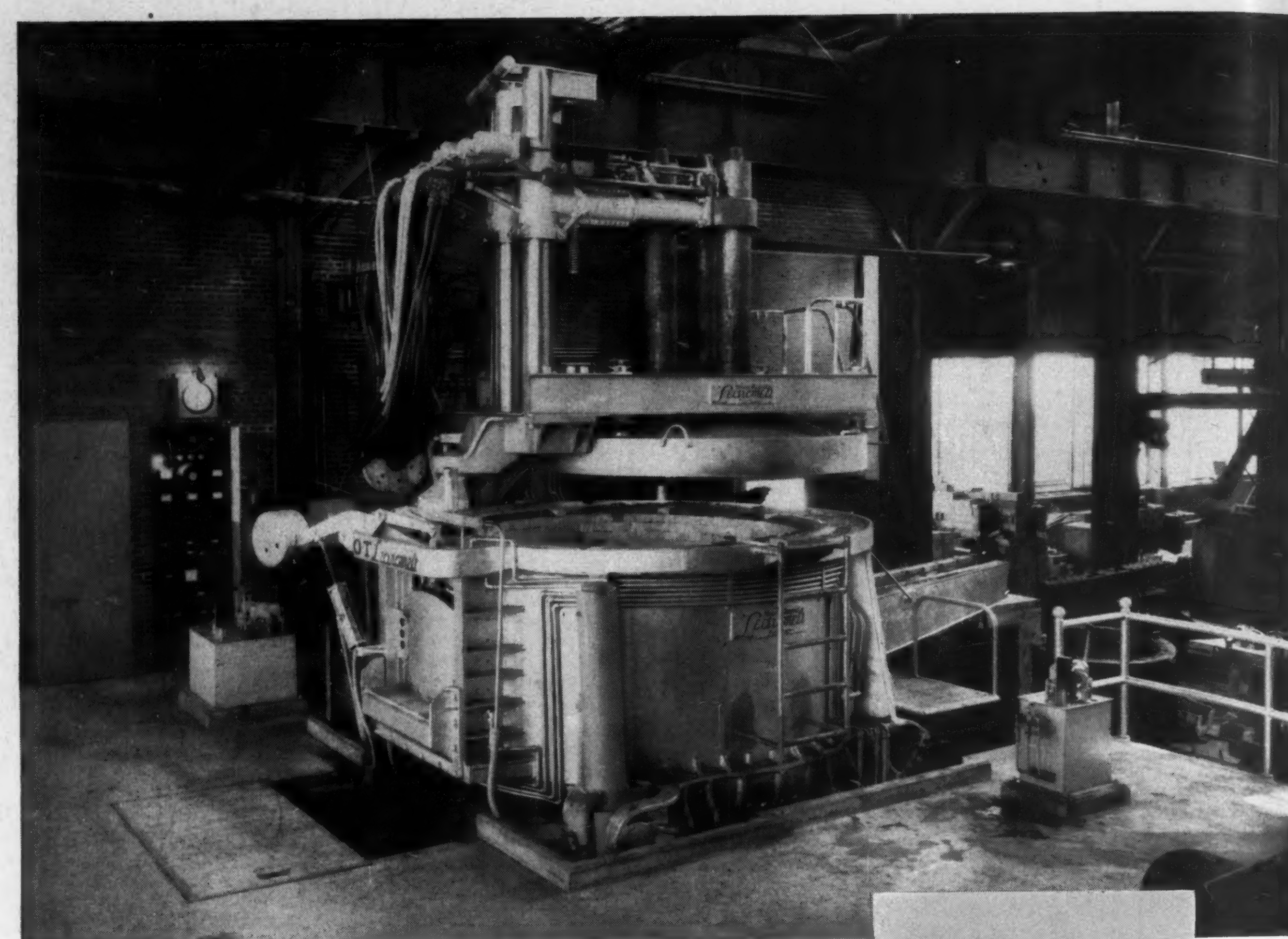
APRIL 1947

American Foundryman

★ THE FOUNDRYMEN'S OWN MAGAZINE

PRE-CONVENTION
ISSUE



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★ APRIL WHO'S WHO ★

J. E. Gill

A young newcomer in the patternmaking field is John Edward Gill, twenty-eight years old, who hails from Erie, Pa. . . . See: *Patterns for Production* . . . Has attended night classes sponsored by both the University of Pittsburgh, Pittsburgh, and University of Minnesota, Minneapolis, specializing in foundry engineering . . . Served his apprenticeship at the Lake Shore Pattern Works, Erie, 1936-40 . . . Was associated with American Hoist & Derrick Co., St. Paul, Minn., as patternmaker from 1940-41 . . . At present is superintendent, Lake Shore Pattern Works, having returned there in 1941 . . . Has spoken before the Venango group, Northwestern Pennsylvania chapter . . . Is a director of the Northwestern Pennsylvania chapter having been active in this group since its founding . . . An A.F.A. member.

E. M. Strick

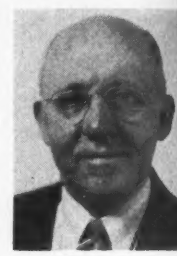
Having had a close association with the malleable foundry industry for over twenty-five years, Earl M. Strick, author of *Malleable Iron Finishing*, presents some new ideas on this subject . . . Born in Erie, Pa., he has taken a number of courses from the University of Pittsburgh, Erie Extension . . . Began his affiliation with Erie Malleable Iron Co., Erie, Pa., in 1915 as foreman . . . During World War I was a gunners mate in the U. S. Navy and was discharged in 1920 . . . Returned to his former position as foreman, Erie Malleable Iron Co. until 1926 when he was named chief inspector . . . From 1928-32 he was connected with Zurn Mfg. Co., Erie, starting as shipping foreman, advancing to machine shop foreman and being appointed production manager . . . Was made superintendent, night operations, upon resuming his affiliation with Erie Malleable Iron Co. in 1933 . . . Three years later joined the statistical and accounting department of the Erie firm . . . In 1939 was appointed to the position he now holds as finishing superintendent . . . A member of A.F.A. he played a prominent part in establishing the Northwestern Pennsylvania chapter, with headquarters in Erie, and is chairman of the group . . . He also holds membership in Malleable Founders Society and is a past director, National Association of Cost Accountants.

J. D. Kline

J. D. Kline was born in Erie, Pa., in 1922 . . . A 1943 graduate of the University of Michigan, Ann Arbor, with a Bachelor of Science degree in metallurgical engineering . . . Became associated with Niagara Falls Smelting & Refining Div., Continental United Industries Co., Inc., Buffalo, N. Y., upon graduation . . . A member of the Spectrographic Society of the Niagara Frontier . . . Author of the paper *"Aluminum Casting Alloy; Fluxes-Degasifiers-Grain Refiners."*

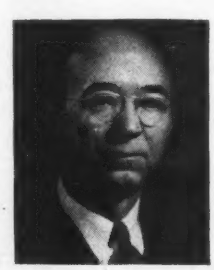
O. J. Myers

O. Jay Myers, foundry research director, Werner G. Smith Co., Div. of Archer-Daniels-Midland, Minneapolis, was born in New York City . . . Received A.B. from Princeton University . . . Later (1942) was awarded a master's degree, geological engineering, by Colorado School of Mines, Golden, Colo. . . . Joining American Smelting & Refining Co., after his graduation from Princeton, he was made assistant geologist . . . His work carried him to San Pedro and San Luis Potosi, Mexico . . . The following year was named fellow in the department of geology, Colorado School of Mines . . . Affiliating with Wright Aeronautical Corp., Lockland, Ohio, in 1942, he was made director of foundry practice . . . Three years later was given his present post with Werner G. Smith Co. . . . Well known in foundry circles as a frequent speaker at A.F.A. chapter meetings . . . Subjects he has covered include core sand reclamation, core sand mixtures and oxidation inhibitors in magnesium . . . A member of A.F.A., AIME and Association Technique de Fonderie . . . See, in this issue, *Foundry Sand Laboratory*.



R. W. Thomas

R. W. Thomas was born in Lebanon, Pa. . . . Is co-author, with M. V. Healey, of the article published herein on *Basic Electric Steel, Single Slag Process* . . . Pennsylvania State College, State College, Pa., is his alma mater . . . He was graduated with a bachelor of science degree in metallurgical engineering in 1917 . . . Began his foundry career with Bethlehem Steel Co., Steelton, Pa., as molder apprentice and later as molder . . . Following graduation joined Vulcan Iron Works, Wilkes Barre, Pa., and remained twenty-three years, leaving in 1940 as superintendent, steel foundry . . . From 1940-41 was on special assignment for Treadwell Engineering Co., Easton, Pa. . . . Appointed assistant general superintendent, Continental Roll & Machine Co., Wheeling, W. Va., he remained a short time . . . Ludlow Valve Mfg. Co., Troy, N. Y., named him superintendent, steel foundry, where he remained until 1943 . . . At present is associated with General Electric Co., Schenectady, N. Y., performing special assignments . . . Has written for International Acetylene Association on acetylene burning as it affects steel casting practice.



W. A. Spindler

A Hoosier by birth, the author hails from Fort Wayne, Ind. . . . Obtained his Bachelor of Science degree from University of Michigan, Ann Arbor (1927) and in 1933 was awarded his Master of Science degree. . . . Began his foundry career with Detroit Gray Iron Foundry, Detroit, (1925-26) as clerk. . . . Became a member

of the metallurgical department, Dodge Bros., Detroit, from 1927-29. . . . Was appointed metallurgist, Detroit Alloy Steel Co., Detroit, and remained there until 1930. . . . Affiliated with University of Michigan (1930-33), Mr. Spindler was named instructor. . . . Assumed his present position as assistant professor, college of engineering, University of Michigan, in 1933. . . . A member of the Committee on Physical Properties of Iron Molding Materials at Elevated Temperatures, A. F. A. Sand Division. . . . Holds membership in A. F. A., AIME, ASM, ASTM, and American Welding Society. . . . Reports on *Immersion Thermocouple, Simplified Protection Tube* in this issue.

C. O. Bartlett

A number of foundries today are modernizing their plants through mechanization . . . Charles O. Bartlett, in this issue, explains *Foundry Mechanization, Design—Operation* . . . Born in Cleveland, Ohio . . . His Bachelor of Science degree in mining was obtained from Case School of Applied Science, Cleveland (1916) . . . Began his industrial career with C. O. Bartlett & Snow Co., Cleveland, in 1919 . . . The following year joined American Agricultural Chemical Co., Cleveland, as manager . . . Was appointed Detroit manager of the same concern in 1923 . . . Assumed the position of sales engineer, Bartlett & Snow, Detroit, in 1940 . . . He was recently named vice-president and sales director of the same firm with his office in Cleveland . . . Holds membership in A.F.A.

L. K. Jenicek

A discussion of *Molding Sand Binders* is published herein and was written by Ladislav Jenicek, assistant professor, Mining and Metallurgical Institute, Prague, Czechoslovakia . . . Mr. Jenicek was born in Litomysl, Czechoslovakia, in 1908 . . . Received his engineering degree from the Institute of Technology, Prague, in 1932 and three years later was awarded his Doctor's degree . . . From 1932-33 was assistant, Institute of Technology, Prague . . . Journeying to Paris, France, he was assistant to Prof. A. Porlevin (1933-35) . . . Was a consulting engineer for ten years (1935-45) and continued his work as assistant, Institute of Technology during 1935-38 . . . In 1946 was appointed to his present position and also assumed the title of research director, United Steelworks . . . Has prepared a number of papers for technical societies dealing with die casting, foundry sand, physics of metals and other related subjects . . . A member of A.F.A., AIME, ASM, American Chemical Society, American Welding Society, Institute of Metals (British), British Iron and Steel Institute, Institute of British Foundrymen.

M. V. Healey

Co-author, with R. W. Thomas, of article on single slag process titled *Basic Electric Steel, Single Slag Process* . . . From the "Show Me" state, city of Atlanta. . . . A graduate of Missouri School of Mines and Metallurgy, Rolla. . . . Has been associated with General Electric Co., Schenectady, N.Y., since 1929 as metallurgical engineer. . . . Mr. Healey is a member of American Foundrymen's Association, American Institute of Mining and Metallurgical Engineers, American Society for Metals and American Society for Testing Materials.

W. E. Thomas

W. E. Thomas, author of *Magnetic Particle Inspection, Foundry Applications,* was born in Columbus, Ohio . . . Graduate of Armour Institute of Technology, Chicago, with a Bachelor of Science degree in mechanical engineering (1928) . . . He has been associated with the Magnaflux Corp., Chicago, since 1939 and at present is vice-president, in charge of sales . . . Mr. Thomas has written a number of articles and spoken before various technical societies on non-destructive inspection of materials . . . Is co-author of the book *"Magnaflux Aircraft Inspection Manual,"* with F. B. Doane . . . Holds membership in Institute of the Aeronautical Sciences and National Aeronautical Association.

W. E. George

Two Ways to Make a Profit is an article prepared by Wally E. George, account manager, Booz, Allen & Hamilton, Chicago, which should be of interest to all foundrymen—molders or presidents . . . Hoosierland claims him; he was born in Indianapolis . . . A graduate of Georgia School of Technology, Atlanta, with a Bachelor of Science degree in civil engineering . . . At Fort Dodge, Iowa, he joined Illinois Central railroad as rodman in 1921 . . . Was made assistant purchasing agent, Certainteed Products Corp., St. Louis (1923-25) . . . Appointed sales engineer, Imperial Brass Mfg. Co., St. Louis, in 1926 . . . From 1928-31 was affiliated with Haynes Corp., Chicago, as supervisor . . . As chief industrial engineer, American Steel Foundries, Chicago, Mr. George was with this firm for six years . . . Connected with Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., (1937-43) he was named assistant to the management . . . Has been with his present associates since 1943 . . . Is as well known as an author and contributor as he is a speaker . . . Subjects include cost reduction, labor relations, wage incentives, job evaluation and related topics . . . Has talked before a number of A.F.A. chapters and meetings of American Management Association, Industrial Management Society (Past President, 1934-36), Society for Advancement of Management and many other cooperative groups.

Donn Boring

Joining Dissimilar Metals, a treatise prepared by Donn Boring, deals with aluminum-bronze electrodes used to weld cast iron and steel . . . Place of birth: Montreal, Quebec . . . As salesman in Montreal (1936-38) he was connected with Plow & Watters . . . Account executive, sales promotion department, Ronalds Co., Montreal, 1938-40 . . . The following year he was connected with the sales promotion staff, Herald Press, Montreal . . . He has been advertising and sales promotion manager, G. D. Peters & Co. of Canada, Ltd., Montreal, since 1941 . . . His writings on welding applications and developments have been published widely.

W. H. Baer

A frequent speaker on radiography is William H. Baer, who presents, in this issue, *Gun Metal Castings, Radiography* . . . Mr. Baer's birthplace was New Athens, Ohio . . . He attended night classes at Villanova College, Villanova, Pa.; University of Pennsylvania, Philadelphia; George Washington University and Catholic University of America, Washington, D. C. . . . Was supervisor and sales manager for a retail concern in Pittsburgh, Pa., from 1932-40 . . . Associated for two years with Summerill Tubing Co., Bridgeport, Pa. . . . Joined the Naval Research Laboratory staff, Washington, D. C., in 1942 as associate metallurgist . . . Has been chosen to speak before a number of A.F.A. chapter meetings and regional conferences and also before American Industrial Radium and X-Ray Society groups . . . Subject generally concerns radiography of bronze castings.

The Foundry Convention and

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For Better IRON Castings

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Write For Bulletin 46-B

The CLEVELAND

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Manufacturers of Iron, Brass and

THE INDUSTRY'S GREATEST OPPORTUNITY FOR JOINT EFFORT

A YEAR AGO, during the 50th Anniversary Convention of A.F.A.—by far the largest foundry convention ever staged—a meeting was held which, while perhaps the smallest and least publicized of all the Convention sessions, may yet prove to have been the most far-reaching and significant in its effects on the foundry industry. That meeting brought together the elected heads of the major foundry associations for discussion of an over-all foundry group.

Out of that meeting has come the National Castings Council, a body that meets periodically, and on call, for informal discussions. From such discussions may develop, tomorrow, the activating force for that over-all organization visualized by more than one foundry executive during the past quarter century.

It is too early to say what may develop from the joint effort; but one thing is certain, such a broad plan must have its foundations in the industry's needs.

Common to all ideas thus far expressed seems to be the thought of a "united front"—a "spokesman group" on questions of concern to all casting interests. That need was demonstrated conclusively during the world wars when divergent, and often conflicting, casting interests were unable to achieve the industry-wide recognition and acceptance many other industries accomplished through group action.

Through conversations of past years has run a note of alarm over "duplication of effort." The hazard lies not in over-lapping or duplication but in waste of effort. As an association grows and progresses, it naturally seeks new ways and means of serving its membership, and "duplication" may follow. As a result, questions of jurisdiction have arisen; and more than one foundry executive has found it difficult to determine to what degree his company and men should participate in each group.

Problems of our industry can best be solved through the concentrated efforts of small groups, working together in a common bond to achieve specific results. Yet joint action on questions common to all interests might be preferable to the separate actions of groups able to speak and act only for a relatively small segment of the industry. Such problems as safety and hygiene, education, and the application of all cast products, for example, can be solved only by united action.

Many broad, overly-idealistic plans for industry-wide cooperation have been broached. Some have visualized a "National Foundry Research Institute." Others have conceived a "National Foundry School" to which promising men might come from foundries for short courses and broader training. Some have seen a need for an organization which could speak in Washington for the industry as a whole.

There has even been proposed a single organization encompassing the activities of all existing foundry groups—a truly theoretical plan. No single organization could continue serving impartially the interests of all.

Whatever the ultimate form of any over-all foundry organization, the National Castings Council has at least provided a means for the discussions of those men who guide the activities of their societies. One must have broad vision indeed to foresee what may develop, and certainly no one man can speak for all the industry. As a personal member of American Foundrymen's Association, rather than as its elected President whose term of office will expire shortly, I believe that the National Castings Council may well prove the activating force for fulfillment of those hopes the industry has expressed for many years. Scientific accomplishments of the past quarter century prove that the castings industry has "grown up" technically. Perhaps the time has come to mature equally its management and organizational possibilities.

S. V. WOOD, *President*
AMERICAN FOUNDRYMEN'S ASSOCIATION

★ ★ ★ TO PREVIEW FOUNDRY

Another eventful post-war year of expanding activity and unabated demand for the products of the Foundry Industry will be reflected in the program for the 51st Annual Meeting of American Foundrymen's Association, opening April 28 in Detroit and continuing through May 1, with several thousand progressive foundrymen attending from all parts of the U.S., Canada and from countries abroad. Drawn by a program featuring papers and reports on the most advanced developments in foundry practice, metallurgy and casting techniques, the industry as a whole will again reap the full benefit of the cooperation which over the past 50 years has meant so much to foundry progress.

With the demand for castings of all types remaining strong, even in the face of new and competitive processes, foundrymen everywhere continue to have difficulty meeting their commitments. Shortages of essential materials have undoubtedly aggravated the situation, placing unusual premiums on the adaptability and versatility of production management. Under such conditions it is only natural that interest in the scientific, practical approach to current problems has stimulated foundrymen in increasing numbers to center their quest for new knowledge and new methods in the cooperative facilities developed by the A.F.A. membership.

As activities and arrangements in connection with the Detroit Convention near completion, more and more signs point to an attendance larger than at any previous non-exhibit foundry congress. Since the membership of A.F.A. is setting new records each successive month and now surpasses the 9400 mark, the proportion of members who check in during the Convention will probably exceed any past figure. At the same time, foundrymen located in and near Detroit have made evident their intention of descending upon the Motor City in large numbers to benefit from the best that the industry has to offer in the way of technical and practical information.

All of the major downtown hotels in Detroit have reported heavy advance reservations and are cooperating splendidly with A.F.A. and the official housing bureau in accommodating 1947 visitors. With 25 hotels working closely with the housing bureau and guaranteeing 2000 rooms for this foundry congress, it is expected that confirmed reservations will be available for all who made advance application for rooms as A.F.A. has urged for several months. Visitors who fail to request accommodations ahead of time must run the usual risk of inconvenience prevailing in any large commercial city today.

The interest in mechanization of foundry operations has received tremendous stimulation, both during and since the recent war, due partly to steadily mounting production costs and to material substitutions and quality requirements. Not only will this subject be discussed during the Detroit Convention sessions, but many examples of foundry mechanization will be open for inspection within the Motor City and its immediate environs.

The Plant Visitation Committee of the Detroit Chapter has organized an impressive program of plant visits to give A.F.A. Convention visitors opportunity for close-up

Detroit's City Hall

51 Annual CONVENTION

★ ★ ★

TECHNIQUES OF TOMORROW

views of foundry operations and improvements. Elsewhere in this issue there appears a list of companies who will cooperate in the plant visitation program during the week. As a climax, the "Ford Day" Committee, headed by R. H. McCarroll of the Ford Motor Co., has arranged a special post-Convention inspection trip to the plants where the assembly line was born.

Registration Made Easy

Convention activities, in the main, will center in two leading Detroit hotels, the Book-Cadillac and the Statler, and registration headquarters will be maintained in both hostelries. With the exception of several important Opening Day sessions, and a key-noting General Meeting, all on Monday, April 28, all formal sessions will be held at these two hotels.

The program committees have arranged meetings for the maximum convenience of convention visitors. Thus, all the sessions dealing with Aluminum and Magnesium, and with Malleable Iron, will be concluded on Monday and Tuesday; Brass and Bronze, on Tuesday and Wednesday; while Steel and Gray Iron topics will be covered on Wednesday and Thursday, with one exception in each case. Thus, it will be possible for visitors to attend a maximum number of sessions dealing with subjects in which they are interested in minimum time.

Every formal paper and report to be presented at this Convention will have been reviewed or approved for presentation by the Program and Papers Committees of the various A.F.A. Divisions. All have been distributed to the membership, either through preprinting or through publication in this issue of AMERICAN FOUNDRYMAN, thus being made available for advanced study. This fine record has been made possible only through the splendid cooperation of the authors and of the Program and Papers Committees and gives the membership an opportunity of adding materially to the value of each paper as it is presented and discussed during the course of the Convention.

Special Events Arranged

The 51st Annual Meeting will be highlighted by a series of special events and general sessions, beginning with a General Meeting the afternoon of April 28 at the beautiful Rackham Educational Memorial. This will not be a luncheon meeting, although buffet luncheon facilities will be available in the Rackham building. George T. Christopher of Detroit will be the featured speaker at this "opening session" and will answer the question *"Why the Importance of the Foundry Industry?"* As president and general manager of Packard Motor Car Co., Mr. Christopher will keynote the Convention and describe the vital relationship which exists between the castings and the automotive industries.

Chapter Officers and Directors of the Association will meet at the Statler Hotel the evening of April 29 for the dinner that has become an annual Convention affair. President S. V. Wood will preside and Vice-President Max Kuniansky will feature the program, emphasizing the importance of Chapters and Chapter Programs to foundry operators everywhere.

On Tuesday, April 29, Canadian

Rackham Educational Memorial

Featured Speakers to Address Detroit Convention

Arthur H. Motley

GUEST SPEAKER at the Annual Banquet of A.F.A. on Thursday, May 1, will be Arthur H. ("Red") Motley, publisher of the "Parade," Sunday picture magazine of national scope. Combining the talents of showmanship, enthusiasm, and excellent speaking ability, Mr. Motley will address the climax dinner on "Tradition—an Asset or a Liability." Having smashed may traditions in the sales-advertising and publishing field, he will turn his guns on the industrial traditions which have proved to be handicaps to national progress.

For 18 years connected with the Crowell-Collier Publishing Co., where he rose to the position of vice-president and director, as well as publisher of the American Magazine, he today is president of Parade Publications, Inc., New York, and has spoken before important business groups all over the country.

George T. Christopher

PRINCIPAL SPEAKER at the General Meeting, Monday afternoon, April 28, to be held in the Auditorium at Rackham Educational Memorial, will be George T. Christopher, president of Packard Motor Car Co., Detroit, whose address on "Why the Importance of the Foundry Industry" will strike a logical keynote for a foundry convention in Detroit. Mr. Christopher, who will be introduced by A.F.A. President S. V. Wood, presiding at this "opening meeting," will emphasize the interrelation of castings production and automotive production, of interest to all convention visitors.

members and guest foundrymen will assemble for a special luncheon session at the Hotel Statler. Since Canada is just across the St. Clair River from Detroit, an especially large attendance of Dominion foundrymen is anticipated. The Canadian Chapters of A.F.A. are now completing another successful year and the interest in improved foundry practice has been steadily increasing. Joseph Sully, President of Sully Foundry Div., Neptune Meters Ltd., Toronto, a National Director of A.F.A., will be Chairman of this meeting.

The annual luncheon for Engineering School graduates is scheduled for Wednesday, April 30, at the Statler Hotel and several score are expected to attend, to greet old friends and to reminisce about their respective alma maters. This informal gathering of foundrymen who received their education at the technical schools and colleges has steadily grown in popularity during recent years and is being repeated in 1947 at the request of numerous past participants.

The Annual Business Meeting of the Association will be held at 2 o'clock the afternoon of April 30, at the Book-Cadillac. On this occasion the President's Annual Address will be presented. Elections of new Officers and Directors will be announced at the meeting; Apprentice Contests awards presented, and J. T. MacKenzie will deliver the Charles Edgar Hoyt Annual Lecture as a Convention highlight.

Gray Iron Program

Numerous subjects of current metallurgical interest are featured on the fine program of the Gray Iron Division this year, including important technical and practical papers on composition, melting methods, inspection, welding, and availability influences on gray cast iron. In addition, four Shop Course sessions will be held, beginning April 28.

Intensified study on the part of metallurgists has developed new information on various phases of melting action. As during the war years, considerable interest is being shown in welding methods for gray iron castings. Outstanding authorities will discuss these two subjects at Detroit. An enlightening forum dealing with structure analysis of gray iron and gray iron castings, scheduled for Thursday, May 1, promises to be one of the most informative in recent years. Because of the timely nature of these discussions, preparations are being made to take care of a large gray iron attendance.

Shop Course sessions on gray iron are scheduled for each day in Detroit with topics in the following order: Monday—*"Variables Affecting Carbon Control in Cupola Operation;"* Tuesday—*"Effect of Coke Quality on Cupola Melting;"* Wednesday—*"Factors Affecting Cost of Cupola Operation;"* and Thursday —*"Variables Affecting Electric Furnace Gray Iron."*

These Shop Course programs represent a blending of the technical with the practical problems of ev-

ery-day production, and thus are of great interest to production men. Material shortages have made foundrymen more interested than ever in the need for adjusting their procedures and methods to meet special conditions. The Shop Courses make possible the informal exchange of ideas and experience, and their usefulness is greatly enhanced by open discussions.

The program of the A.F.A. Sand Division for the Annual Convention will be highlighted by a Committee report on *"New Tentative Standards for Grading and Fineness of Sands,"* to be presented for discussion the morning of April 30. The division has scheduled three technical sand sessions on April 29, 30 and May 1, featuring papers of penetrating scope. Authorities on sand research will participate in the discussion of subjects relating to physical properties, evaluation of sand test data, and laboratory test methods.

As with the Gray Iron Program, four Sand Shop Course sessions have been arranged, one each day of the week, dealing with sand problems of malleable iron, non-ferrous, steel, and gray iron work. All sessions are informal and unreported for freedom of questioning and discussion. Shop Course subjects include the following: Monday—*"Malleable Sand Problems;"* Tuesday—*"Your Sand Pile,"* dealing with non-ferrous sands; Wednesday—*"The Role of Sand in Hot Tearing;"* and Thursday—*"Variables in Gray Iron Sand Practice."*

Light Metals Meetings

Three technical sessions and one Round-Table meeting have been arranged by the Aluminum and Magnesium Division, all scheduled the first two days of the Convention, and the increasing interest in this division is expected to turn out a strong attendance. Subject matter is evenly distributed between Aluminum and Magnesium and prominent speakers will report findings uncovered by the most advanced research in the field of light metal castings. The technical sessions on Monday will be held at Rackham, Tuesday's sessions at the Book-Cadillac Hotel.

Among the various subjects are techniques in leakproofing light metal castings, simplification of casting design, and new gating techniques for magnesium alloys. An especially practical paper will deal with pinhole blows in magnesium castings; and the Round-Table, with discussion off-the-record, will cover recommended practices for aluminum and magnesium castings.

Complete Malleable Program

The Malleable Iron Division's program has been concentrated on Monday and Tuesday, comprising three technical sessions and a Round-Table. In addition, malleable sand problems will be considered at a Sand Shop Course, Monday evening.

A wealth of information will be presented at these meetings, with papers on finishing and inspection, materials handling, mechanization, and composition. At Tuesday's Round-Table luncheon for the malleable group, off-the-record discussions will cover *"Exothermic Ladle Additions," "Grinding of Malleable Gates,"* and *"Chromium Determinations."*

Technicians from U.S. naval shipyards and laboratories, reporting results of recent metallurgical investigations will figure prominently in the program arranged by the Brass and Bronze Division, all sessions being scheduled on Tuesday and Wednesday. Three naval men will participate with papers on radiography, magnesium bronze segregation, and degasification of cast monel. Papers by other authors will concern test bar properties and spectrographic analysis of ingots, while the round-table luncheon will be essentially practical and deal with melting of brass and bronze. One of the Sand Shop Courses also will be of interest to non-ferrous foundrymen.

Steel Highlights

For members of the Steel Division, in a program to be staged principally on Wednesday and Thursday, with one Tuesday afternoon session, four technical sessions and a Round-Table luncheon have been set up. Interest in the Steel program is already running high because of the nature of the papers listed. Steel foundrymen of this country and abroad have prepared

Downtown Detroit

papers dealing with structural studies, temperature determination and distribution in molten metals and molds, and slag factors in electric furnace operation. The division's Round-Table luncheon has been scheduled for May 1.

Featuring Tuesday's steel session will be the Annual Exchange Paper from the Institute of British Foundrymen, authored by F. Cousans, Catton & Co. Ltd., of Leeds, England. His subject, *"Side-Blown Converter Practice,"* will be well received, because the I.B.F. contribution to the A.F.A. program maintains the oldest international exchange paper arrangement existing between any two societies, dating back to 1921.

Pattern Sessions Set

A relatively recent development in Patternmaking will be presented at the Patternmaking session on Tuesday, dealing with plastic patterns. At the same time, a paper dealing with problems on purchasing patterns is scheduled. The other Patternmaking Division session will be an off-the-record Round-Table luncheon program bearing on cooperation between foundrymen and patternmakers.

Important Educational Topics

The Educational Division of A.F.A. starts its first Convention program under division status with two regular paper sessions on Monday, and promises to hold a great deal of interest for foundry management and others interested in training work. Foreman training, apprentice training, and the training of college graduates for foundry work are three important subjects to be discussed. A special educational dinner has been arranged for Monday night, again of great interest to management. R. L. Lee of General Motors Corp., will speak on *"Management's Stake in Personnel Training."*

A third session sponsored by the Educational Division will be the luncheon for graduates of engineering schools and colleges, Wednesday. Also pertaining to training, the A.F.A. educational program will be augmented by the Apprentice Contests which this year have stimulated an unusually large number of entries.

The need for stimulating interest in foundry work among the youth of America is widely recognized and methods for extending the scope of this program will be discussed in Detroit. During the past year A.F.A. President S. V. Wood has urged, before Chapter meetings, a more realistic approach to the problem of training foundry manpower and has found widespread interest among foundry management. No problem goes so deep or affects the industry as a whole more than the one of education.

During the sessions sponsored by the Educational Division, heads of foundry personnel departments and of foundry management will be brought up-to-date on the cooperative actions already under way in the industry. Announcements of great interest to all foundry executives will be made at the educational dinner on Monday, and again at the Annual Business Meeting on Wednesday afternoon. During the week individual foundrymen will report on efforts to establish better plant relationships between management and employees.

General Interest Sessions

In addition to the program sponsored by the eight A.F.A. Divisions, various general interest committees will sponsor important sessions. The Foundry Cost session, for example, planned to be of interest to management particularly, will deal with cost controls and accurate cost determinations. Our evolving post-war economy, bringing with it more exacting demands on management, increases the value of this session.

Closely akin to the subject of costs

Michigan Plants Schedule Inspection Hours

As ANNOUNCED in the March issue of AMERICAN FOUNDRYMAN, some 15 Michigan plants are cooperating with the A.F.A. Convention by opening their plants for the inspection of visitors during Convention week.

Plants in the Detroit area available for inspections from April 28 to May 1 are as follows:

Monday to Thursday, inclus.

American Car & Foundry Co. (molding and machining of lubricating valves) 10 am-12 noon.

Atlas Foundry Co.—(general jobbing and "Meehanite")—10 am-12 noon, 1:30-3 pm.

Central Iron Foundry Co. (heavy gray iron jobbing work)—10 am-12 noon.

City Pattern Foundry & Machine Co. (brass and aluminum foundry)—9 am-3 pm.

Detroit Gray Iron Foundry Co. (general jobbing work)— 2-5 pm.

Federal Mogul Corp. (bronze foundry and machine shop)—9:30-11 am and 1:30-3 pm.

Kelsey-Hayes Wheel Co. (centrifugal casting of brake drums)—1-3 pm.

Michigan Steel Casting Co.—(precision castings)—9 am-3 pm.

Motor & Machinery Castings Co. (gray iron jobbing foundry)—10 am-12 noon, 1:30-3 pm.

Riley Stoker Corp.—(Gray Iron Duplexing with Electric Furnaces)—10 am-12 noon.

U.S. Radiator Corp. (large sectional heating boilers)—10 am-2 pm.

Outside Detroit

Buick Motor Car Div., General Motors Corp., Flint—9:30-10 am.

General Foundry & Mfg. Co., Flint—(Semi-production foundry) — 9:30-11 am, 1:30-3 pm.

Saginaw Malleable Iron Div., General Motors Corp., Saginaw—9:30-11 am, 1:30-3 pm.

Tuesday, Wednesday only

Sherwood Brass Works (mechanized foundry)—1:30-3:30 pm.

Tuesday, Wednesday, Thursday only

Detroit Steel Castings Co. (new installation of electric furnaces)—morning.

Packard Motor Car Co. (foundry and car assembly line) twice daily—9:30 am, 1:30 pm; maximum visitors each group, 20. Tour will not exceed 2 hrs.

Wednesday, Thursday only

Cadillac Motor Car Div. (foundry and car assembly line)—3 times daily—10 am, 1 pm, 3 pm; maximum visitors each group, 25. Tour not to exceed 2 hrs.

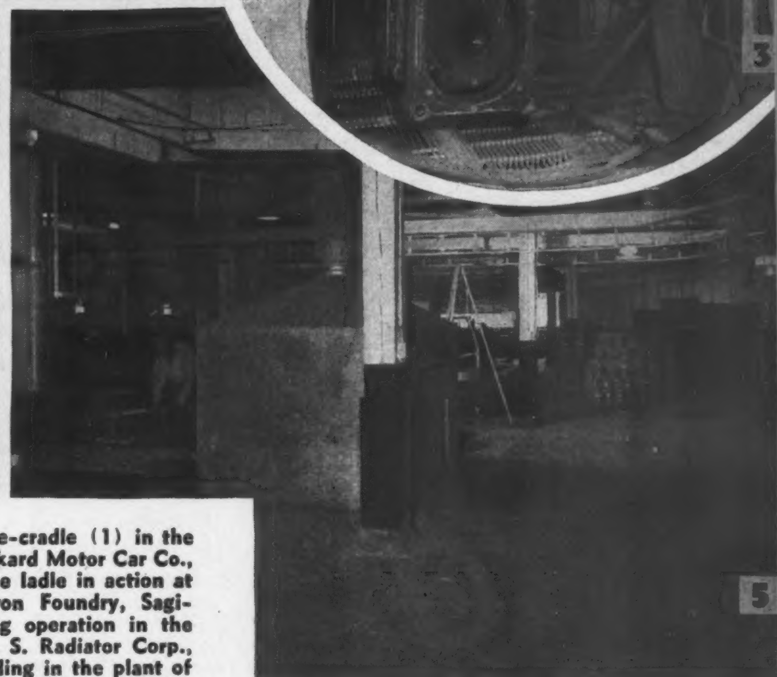
Friday, May 2

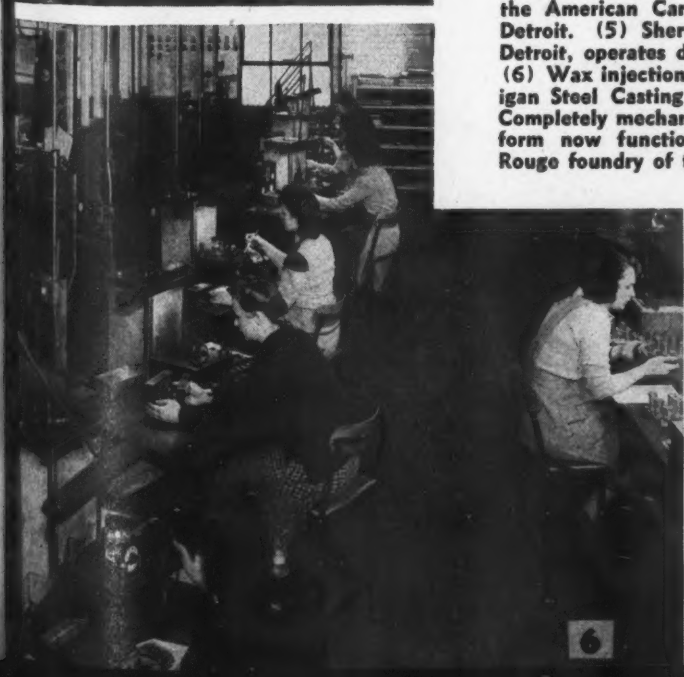
Ford Motor Co.—Special "Ford Day" inspection trip—Lvg. Book-Cadillac Hotel 9:30 am, rtn. approx. 2:30 pm.

Plant visitation desks will be maintained at both the Book-Cadillac and Statler Hotels, where visitors will find information on schedules and transportation. These convenient desks will be manned by members of the Plant Visitation Committee of the Detroit Chapter, under chairmanship of H. M. Bringhurst, Semet-Solvay Co.

Visitors Welcome

Foundrymen attending the 51st A.F.A. convention will have an opportunity to visit many interesting Michigan foundries including those pictured on this page.





Cylinder block core-cradle (1) in the foundry of the Packard Motor Car Co., Detroit. (2) Crane ladle in action at Chevrolet Grey Iron Foundry, Saginaw. (3) Cleaning operation in the foundry of the U. S. Radiator Corp., Detroit. (4) Molding in the plant of the American Car and Foundry Co., Detroit. (5) Sherwood Brass Works, Detroit, operates dust control system. (6) Wax injection machines at Michigan Steel Casting Co., Detroit. (7) Completely mechanized charging platform now functioning in the River Rouge foundry of the Ford Motor Co.

are the elements of Job Evaluation and Time Study, and the A.F.A. Committee dealing with this subject has arranged two meetings on May 1, both pertaining to the establishment and use of standard data. Accurate time study analyses on even the most routine of operations have revealed existence of wasteful practices and, with high labor costs to contend with, alert management has learned that efficiency in all operations is essential to effective plant operation today.

A further session, scheduled for Wednesday evening and sponsored by the Plant and Plant Equipment Committee, closely involves the question of unit costs and efficiency. This meeting will be concerned with the design and operating phases of mechanized foundries, a subject of considerable interest to foundrymen at this time.

The Castings Inspection Committee continues active as in previous Conventions and has scheduled its annual session Tuesday evening. This year the speakers selected have prepared papers and discussions dealing with radiography and with magnetic particle inspections.

The annual meeting of the Refractories Committee, also on Tuesday's program, will receive a paper on furnace refractories. In addition, as announced in previous editions of AMERICAN FOUNDRYMAN, a special *"Information Please"* question and answer panel on refractories problems will feature this part of the program. All A.F.A. members are invited to submit practical problems which they desire answered.

During the past several years, A.F.A. has sponsored fundamental research on heat transfer problems at Columbia University and at Battelle Memorial Institute. Reports on this work, together with additional material developed in the industry, will be offered before two important sessions, sponsored by the Heat Transfer Committee, on April 29. Papers scheduled include the official committee report, solidification studies, and calculations on gating and feeding castings. The growing interest in the subject of heat transfer among foundry metallurgists is reflected in these two sessions, which undoubtedly will be well attended.

Classified Program A.F.A. Convention

(By Subjects and Divisional Interests)

Aluminum and Magnesium

Monday, April 28
10:00 AM—Technical Session
4.00 PM—Technical Session
Tuesday, April 29
10:00 AM—Technical Session
12:00 PM—Round Table (Luncheon)
8:00 PM—Sand Shop Course, Non-Ferrous

Brass and Bronze

Tuesday, April 29
10:00 AM—Technical Session
2:00 PM—Technical Session
8:00 PM—Sand Shop Course, Non-Ferrous
Wednesday, April 30
12:00 PM—Round Table (Luncheon)

Canadian Meeting

Wednesday, April 30
12:00 PM—Canadian Member's Luncheon

Chapter Officers Meeting

Tuesday, April 29
7:00 PM—Chapter Officers and Directors Dinner

Costs

Thursday, May 1
2:00 PM—Technical Session

Educational

Monday, April 28
4:00 PM—Technical Session
7:00 PM—Dinner Session

Gray Iron

Monday, April 28
4:00 PM—Shop Course, Carbon Control in Cupola
Tuesday, April 29
2:00 PM—Technical Session
8:00 PM—Shop Course, Coke Quality on Melting
Wednesday, April 30
10:00 AM—Technical Session
8:00 PM—Shop Course, Cost of Cupola Operation
Thursday, May 1
10:0 AM—Technical Session
2:0 PM—Technical Session
2:00 PM—Shop Course, Electric Furnace Gray Iron
4:00 PM—Sand Shop Course, Gray Iron

Heat Transfer

Tuesday, April 29
10:00 AM—Technical Session
8:00 PM—Technical Session

Inspection

Tuesday, April 29
8:00 PM—Technical Session

Patternmaking

Tuesday, April 29
4:00 PM—Technical Session
Thursday, May 1
12:00 PM—Round Table (Luncheon)

Plant and Plant Equipment

Wednesday, April 30
8:00 PM—Technical Session

Refractories

Tuesday, April 29
4:00 PM—Technical Session

Sand Practice and Research

Monday, April 28
8:00 PM—Sand Shop Course, Malleable
Tuesday, April 92
2:00 PM—Technical Session
8:00 PM—Sand Shop Course, Non-Ferrous
Wednesday, April 30
10:00 AM—Technical Session
8:00 PM—Sand Shop Course, Steel
Thursday, May 1
2:00 PM—Technical Session
4:00 PM—Sand Shop Course, Gray Iron

Steel

Tuesday, April 29
2:00 PM—Technical Session
Wednesday, April 30
10:00 AM—Technical Session
8:00 PM—Sand Shop Course, Steel
Thursday, May 1
10:00 AM—Technical Session
12:00 PM—Round Table (Luncheon)
4:00 PM—Technical Session

Job Evaluation and Time Study

Thursday, May 1
10:00 AM—Technical Session
4:00 PM—Technical Session

Malleable

Monday, April 28
10:00 AM—Technical Session
4:00 PM—Technical Session
8:00 PM—Sand Shop Course, Malleable
Tuesday, April 29
10:00 AM—Technical Session
12:00 PM—Round Table (Luncheon)

Luncheons and Dinners

Monday, April 28
12:00 PM—Buffet Luncheon
7:00 PM—Educational Dinner
Tuesday, April 29
12:00 PM—A.F.A. Executive Committee Luncheon
12:00 PM—Aluminum and Magnesium Round Table Luncheon
12:00 PM—Malleable Round Table Luncheon
7:00 PM—Chapter Officers and Directors Dinner
Wednesday, April 30
12:00 PM—Canadian Members' Luncheon
12:00 PM—Brass and Bronze Round Table Luncheon
12:00 PM—Engineering School Graduates Luncheon
7:00 PM—A.F.A. Alumni Dinner
Thursday, May 1
8:30 AM—Cost Committee Breakfast
12:00 PM—Steel Round Table Luncheon
12:00 PM—Pattern Round Table Luncheon
7:00 PM—Annual Banquet

Ladies PROGRAM

. . . Holds Many Attractions

FOUR DAYS OF COLORFUL entertainment await the ladies planning to attend the 51st annual convention of the American Foundrymen's Association in Detroit. Advance indications are that more than 800 wives and daughters of A.F.A. members will register for the parties, plant visitation and sightseeing trips, luncheons, shopping tours, theatre groups, and other activities arranged for the convention by the host chapter's Ladies Entertainment Committee, headed by Mr. and Mrs. H. W. Dietert of Detroit.

Program climax will be the Association's annual banquet to be held the evening of Thursday, May 1, in the Grand Ballroom of the Book-Cadillac Hotel.

On the opening day of the 51st Congress, Monday, April 28, the ladies will assemble for a three-o'clock tea at the Women's City Club. Mrs. Grace Erb and Mrs. S. Wells Utley will pour, assisted by the wives of past chairmen of the Detroit chapter. Mrs. C. Richard Brand, harpist, will entertain.

Feature of the program for the following day is a tour of the Ford Motor Co., Rouge plant, which will afford a close-up of one of the world's most absorbing industrial scenes. Buses leaving the Book-Cadillac Hotel at 9:30-10:00 a.m. will provide transportation to the Ford Rotunda Building, in Dearborn, from which the ladies will be conducted to the huge Rouge plant and the Ford company's final assembly line. Luncheon will be served at one o'clock in the famous Dearborn Inn, where members of the Ford Motor Co. entertainment group will present a musical program. After luncheon the ladies will visit the Edison Museum and picturesque Greenfield Village.

On Wednesday, April 30, buses will leave the Book-Cadillac Hotel for a Canadian sight-seeing and shopping tour. The trip to Windsor, Ontario, will be by way of the Detroit River Tunnel, and the ladies will disembark at the Prince Edward Hotel for a visit to the shops of Windsor. Luncheon will be served at the Detroit Yacht Club on beautiful Belle Isle, a picturesque, 985-acre playground in the Detroit River. If time permits, buses will then take the ladies along Lakeshore Drive and through Grosse Pointe Villages, with return to the hotels scheduled for 4:30 p.m. Nature should be at her best in late April; rose gardens will be in bloom at Belle Isle, and the returning trip through the Villages should provide a delightful experience.

The Detroit Street Railways has made new deluxe buses available to the ladies for the tours. These buses seat 45 and provide the ultimate in travel comfort.

Representatives of the Ladies Entertainment Committee of the Detroit chapter will be on hand at registration headquarters in both the Book-Cadillac and Statler hotels throughout convention week, and special Parlors will be open, including evenings, for cards and other entertainment. Theatre tickets will be obtainable on request for any of the Detroit theatres or its Music Hall.

On Friday the ladies will be free to shop or to visit Detroit's Institute of Arts, Zoological Park, Palmer Park and many other spots of local interest. The Institute is devoted to the arts of Asia, Europe and America and is open daily, except Monday, until 10 p.m. The Detroit area has other centers of historic and cultural interest which are readily reached by motor or bus.

Tickets for the tours and parties will be available at the Ladies Registration headquarters. Books of tickets covering all events will be one dollar each to ladies carrying membership or to those who are wives of A.F.A. members. Registration for all events for non-member ladies and the wives of non-members will be five dollars. Where a full schedule is not wanted by non-member lady guests, single tickets may be secured for two dollars.

Registration Set-up at Detroit Best Ever

REGISTRATION FACILITIES provided during the Detroit Convention are being arranged for maximum convenience of visitors and will be more extensive than at any previous A.F.A. Annual Meeting. Foundrymen will find Registration Headquarters at *both* the Book-Cadillac and the Statler Hotel throughout the week, and special facilities for registration will be set up at Rackham Educational Memorial for Monday, April 28 only, in connection with the sessions to be held there on Opening Day.

Thus, arrivals on April 28 will be able to register at any one of three locations—Rackham, Statler Hotel, and Book-Cadillac Hotel. *After Monday,* however, all registration will be at either the Book-Cadillac or Statler locations. Registration counter at the Statler will be located in the Main Lobby, and at the Book-Cadillac on the Ballroom Floor, opposite the main entrance to the Grand Ballroom.

A feature of many recent Conventions has been the registration of "Old Timers," foundrymen who have been in the industry for 25 years and 50 years, or more. In 1946, 652 registrants were awarded 25 or 50 year badges and registration facilities will be provided in 1947 at both the Book-Cadillac and Statler Hotels.

Advance Registration Cards have been sent to all A.F.A. members which, if filled out in advance of the Convention, will enable a member to register at Detroit in minimum time. On arrival at Registration Headquarters in Detroit, it will only be necessary to present the filled-out registration card and receive the official Association identification badge.

Annual 51

CONVENTION PROGRAM

DETROIT · APRIL 28th—MAY 1st

The Speakers
Their Subjects
Division Meetings
Annual Banquet

MONDAY, APRIL 28

8:30 AM—Registration.
Hotel Statler.
Book-Cadillac Hotel.

10:00 AM (A)—Aluminum and Magnesium.
(Sponsored by Aluminum and Magnesium Division)

Presiding—W. E. Sicha, Aluminum Co. of America, Cleveland.
Co-Chairman—J. C. DeHaven, Battelle Memorial Institute, Columbus.
"Influence of Inclusions on Properties of Sand Cast Aluminum Base Alloys"—By A. W. Dana, Jr., L. J. Ebert, and G. Sachs, Case School of Applied Science, Cleveland.
"Some Causes of Pinhole Blows in Magnesium Alloy Castings"—By H. H. Fairfield and A. E. Murton, Bureau of Mines, Ottawa, Ont., Canada.

10:00 AM (B)—Malleable Foundry Practice.
(Sponsored by Malleable Division)

Presiding—C. F. Joseph, Central Foundry Div., General Motors Corp., Saginaw, Mich.
Co-Chairman—W. D. McMillan, International Harvester Co., Chicago.
"Malleable Iron Finishing"—By E. M. Strick, Erie Malleable Iron Co., Erie, Pa.
"Malleable Foundry Finishing and Inspection"—By T. E. Poulson, Belle City Malleable Iron Co., Racine, Wisconsin.

2:00 PM—General Meeting.

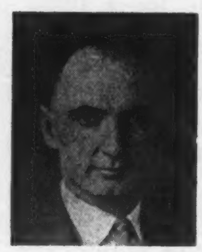
Presiding—S. V. Wood, President, A.F.A.
"Why the Importance of the Foundry Industry"—G. T. Christopher, Packard Motor Car Co., Detroit.


R. E. Morey


V. Paschkis

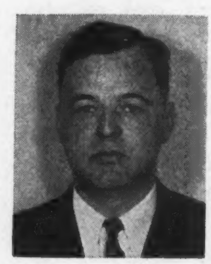

H. W. Lownie, Jr.


J. C. DeHaven


V. A. Crosby


J. H. Hall


H. E. Elliott


T. E. Kihlgren


W. Mader


A. F. Faber, Jr.


E. L. Thomas


C. H. Lorig


H. M. St. John


M. C. Udy


R. E. Ward


H. F. Taylor


G. E. Dalbey


E. C. Zirzow


E. A. Loria


W. E. Sicha


H. W. Dietert


F. G. Sefing


A. S. Klopf


James Thomson


C. W. Briggs


H. H. Fairfield


A. W. Gregg


G. P. Halliwell


C. E. Nelson


R. Schneidewind

PROGRAM

MONDAY, APRIL 28 *(Cont.)*

4:00 PM (A)—Aluminum and Magnesium.

(Sponsored by Aluminum and Magnesium Division)

Presiding—R. E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.

Co-Chairman—W. Mader, Oberdorfer Foundries.

"Effect of Room Temperature Intervals Between Quenching and Aging of Aluminum Sand Casting Alloys"—By R. A. Quadt, Federated Metals Div., American Smelting & Refining Co., Perth Amboy, N. J.

"Methods of Impregnation to Leakproof Aluminum and Magnesium Alloy Castings"—By E. V. Blackmun, Aluminum Co. of America, Cleveland.

4:00 PM (B)—Educational.

(Sponsored by Educational Division)

Presiding—F. C. Cech, Cleveland Trade School.

Co-Chairman—B. D. Claffey, General Malleable Corp., Waukesha, Wis.

"Management's View of Apprentice Training"—By R. S. Falk, Falk Corp., Milwaukee.

"Foundry Training Course for College Graduates"—By A. W. Gregg, Whiting Corp., Harvey, Ill.

"Foreman Training"—By S. G. Garry, Caterpillar Tractor Co., Peoria, Ill.

4:00 PM (C)—Malleable Foundry Practice.

(Sponsored by Malleable Division)

Presiding—R. J. Anderson, Belle City Malleable Iron Co.

Co-Chairman—J. A. Durr, Albion Malleable Iron Co., Albion, Mich.

"Material Handling in a Malleable Foundry Processing Department"—By N. J. Henke, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.

"Mechanized Malleable Foundry Finishing and Inspection"—By D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.

4:00 PM (D)—Gray Iron Shop Course (Session 1).

(Sponsored by Gray Iron Division, Shop Operation Course Committee)

Presiding—E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.

Co-Chairman—J. E. Coon, Packard Motor Car Co.

Subject—*"Variables Affecting Carbon Control in Cupola Operation."*

Discussion Leader—W. W. Levi, Lynchburg Foundry Co., Radford, Va.

PROGRAM

MONDAY, APRIL 28 *(Cont.)*

7:00 PM—Educational.
(Sponsored by Educational Division)

Presiding—A. W. Gregg, Whiting Corp.
Co-Chairman—F. G. Sefing, International Nickel Co., New York.
Subject—*"Management's Stake in Personnel Training."*
Discussion Leader—Dr. R. L. Lee, General Motors Corp., Detroit.

8:00 PM—Sand Shop Operation Course (Session 1).
(Sponsored by Sand Division, Sand Shop Operation Course Committee)

Presiding—D. F. Sawtelle, Malleable Iron Fittings.
Co-Chairman—E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.
Subject—*"Malleable Sand Problems."*
Discussion Leader—D. Tamor, American Chain & Cable Co., Inc., York, Pa.

TUESDAY, APRIL 29

10:00 AM (A)—Aluminum and Magnesium.
(Sponsored by Aluminum and Magnesium Division)

Presiding—R. T. Wood, American Magnesium Corp., Cleveland.
Co-Chairman—Hiram Brown, Solar Aircraft Corp., Des Moines, Iowa.
"The Simplification of Light Metal Casting Design and Its Effect Upon Serviceability"—By W. T. Bean, Jr., Continental Aviation & Engineering Corp., Detroit.
"A New Gating Technique for Magnesium Alloy Castings"—By H. E. Elliott and J. G. Mezoff, Dow Chemical Co., Bay City, Mich.

10:00 AM (B)—Brass and Bronze.
(Sponsored by Brass and Bronze Division)

Presiding—H. M. St. John, Crane Co., Chicago.
Co-Chairman—A. K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee.
"Radiography of Gun Metal Castings"—By W. H. Baer, Naval Research Laboratory, Washington, D. C.
"Segregation in Manganese Bronze"—By G. E. Dalbey, Mare Island Naval Shipyard, Vallejo, Calif.
"Spectrographic Analysis in the Manufacture of Brass and Bronze Ingots"—By G. P. Halliwell and G. E. Staahl, H. Kramer & Co., Chicago.


D. F. Sawtelle


W. H. Baer


A. K. Higgins


H. H. Wilder


J. E. Bowen


E. V. Blackmun


H. L. Smith


J. G. Kura


B. D. Claffey


C. F. Joseph

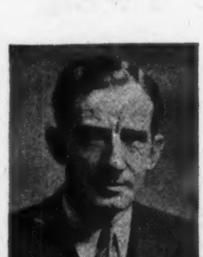

S. V. Wood


B. A. Miller


J. A. Westover


O. J. Myers


D. J. Reese


B. P. Mulcahy


G. K. Dreher


Ralph L. Lee

F. A. Melmoth

R. J. Fisher

R. H. Stone

E. W. Beach

J. A. Rassenfoss

D. C. Williams

K. H. Priestly

J. Sully

J. B. Caine

R. L. Dowdell

C. K. Donoho

Dr. R. L. Lee

A. P. Thompson

L. W. Eastwood

A. M. Fulton

R. S. Falk

H. F. Bishop

G. A. Timmons

PROGRAM

TUESDAY, APRIL 29 *(Cont.)*

10:00 AM (C)—Heat Transfer.

(Sponsored by Heat Transfer Committee)

Presiding—H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

Co-Chairman—E. C. Troy, Dodge Steel Co., Philadelphia.

"Heat Transfer Committee Report."

"Studies on Solidification of Castings"—By V. Paschkis, Columbia University, New York.

"Solidification Rates of Aluminum in Dry Sand Molds"—By H. Y. Hunsicker, Aluminum Co. of America, Cleveland.

"Calculating the Size of Gates–Risers"—By N. Janco, Centrifugal Casting Machine Co., Tulsa, Okla.

10:00 AM (D)—Malleable Foundry Practice.

(Sponsored by Malleable Division)

Presiding—V. A. Crosby, Climax Molybdenum Co.

Co-Chairman—Milton Tilley, National Malleable & Steel Castings Co., Cleveland.

"An Interpretation of the Constitution of Iron-Carbon-Silicon Alloys"—By J. E. Rehder, Bureau of Mines, Ottawa, Ont., Canada.

"Effect of Section Size and Annealing Temperature on the Graphitization of White Cast Iron"—By D. J. Reese, International Nickel Co., New York; R. Schneidewind and A. Tang, University of Michigan.

12:00 PM (A)—Aluminum and Magnesium Round Table Luncheon.

(Sponsored by Aluminum and Magnesium Division)

Presiding—D. L. Colwell, National Smelting Company, Chicago.

Co-Chairman—C. E. Nelson, Dow Chemical Co.

Subject—*"Recommended Practices for Aluminum and Magnesium Casting."*

Discussion Leader—W. E. Martin, Beryllium Corp.

12:00 PM (B)—Malleable Luncheon.

(Sponsored by Malleable Division)

Presiding—A. M. Fulton, Northern Malleable Iron Co., St. Paul, Minn.

Co-Chairman—J. H. Lansing, Malleable Founders' Society, Cleveland.

Subjects—*"Chromium Determinations."*
"Grinding of Malleable Gates."
"Exothermic Ladle Additions."

Discussion Leader—C. F. Lauenstein, Link-Belt Co.

PROGRAM

TUESDAY, APRIL 29 *(Cont.)*

2:00 PM (A)—Brass and Bronze.

(Sponsored by Brass and Bronze Division)

Presiding—G. P. Halliwell, H. Kramer & Co., Chicago.

Co-Chairman—B. M. Loring, Naval Research Laboratory, Washington, D. C.

"Correlation of Structure and Properties 85-5-5-5 Alloy Test Bars"—By J. G. Kura and L. W. Eastwood, Battelle Memorial Institute, Columbus.

"Gas Absorption Phenomena and Degasification of Cast Monel"—By B. N. Ames and N. A. Kahn, New York Naval Shipyard, New York.

2:00 PM (B)—Steel.

(Sponsored by Steel Division)

Presiding—C. W. Briggs, Steel Founders' Society of America, Cleveland.

Co-Chairman—L. H. Hahn, Sivyer Steel Castings Co., Chicago.

"Side-Blown Converter Practice"—By F. Cousans, Catton & Co., Ltd., Leeds, England—Institute of British Foundrymen Exchange Paper.

"Effect of Melting Practice on Properties of Medium-Carbon Low Alloy Cast Steels"—By J. G. Kura and N. H. Keyser, Battelle Memorial Institute, Columbus, Ohio.

"The Influence of Selenium on the Sulphide Form and Ductility of Cast Steel"—By A. P. Gagnebin, International Nickel Company, Incorporated, Bayonne, New Jersey.

2:00 PM (C)—Sand.

(Sponsored by Sand Division)

Presiding—E. C. Zirzow, National Malleable & Steel Castings Co.

Co-Chairman—C. R. Wolf, New Jersey Silica Sand Co., Millville, N. J.

"Elevated Temperature Properties of Steel Foundry Sands"—By D. C. Williams, Cornell University, Ithaca, N. Y.

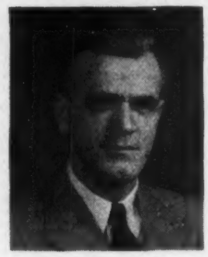
"Preparation of Foundry Sands for Market"—By F. P. Goettman, George F. Pettinos, Incorporated, Philadelphia.

"Committee Report on Evaluation of Core Knockout"—By H. W. Dietert, Harry W. Dietert Co., Detroit, Mich.

E. J. Hasty

S. G. Garry

B. H. Booth



C. R. Simmons

J. T. MacKenzie

M. Annich

J. G. Mezoff

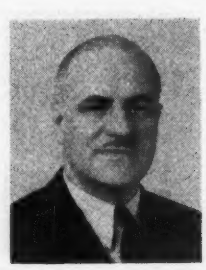
W. D. McMillan

S. W. Brinson

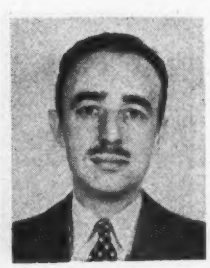
R. G. McElwee

R. W. Lindsay

B. M. Loring



C. E. Westover



C. A. Nagler

B. N. Ames

V. J. Sedlon

H. C. Stone

E. L. LaGrelius

J. A. Durr

N. A. Kahn

R. A. Quadt

W. M. Ball, Jr.

K. E. Davis

T. E. Poulson

Hiram Brown

D. L. Colwell

L. J. Ebert

Hyman Bornstein

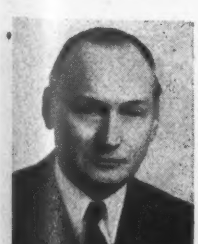
C. J. Rittinger

H. H. Johnson

R. J. Anderson

J. H. Lansing

A. W. Dana, Jr.



R. J. Keeley

H. O. McIntire

A. R. Elsea

PROGRAM

TUESDAY, APRIL 29 *(Cont.)*

2:00 PM (D)—Gray Iron.

(Sponsored by Gray Iron Division)

Presiding—R. G. McElwee, Vanadium Corp. of America, Detroit.

Co-Chairman—W. W. Levi, Lynchburg Foundry Co.

"Cupola Melting Phenomena"—By D. W. Gunther and E. V. Somers, Westinghouse Electric Corp., Trafford, Pennsylvania.

"Arc Welding of Cast Iron with Nickel Electrodes"—By T. E. Kihlgren and L. C. Minard, International Nickel Co., Bayonne, N. J.

4:00 PM (A)—Refractories.

(Sponsored by Refractories Committee)

Presiding—R. H. Stone, Vesuvius Crucible Co., Pittsburgh.

Co-Chairman—A. S. Klopf, Western Foundry Co., Chicago.

"Special Refractories in Metal Melting"—By W. H. Henson, Norton Co., Worcester, Mass.

"Information Please"—Question and Answer Panel.

4:00 PM (B)—Patternmaking.

(Sponsored by Pattern Division)

Presiding—V. J. Sedlon, Master Pattern Co.

Co-Chairman—A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.

"A Purchasing Agent's Considerations in Purchasing Patterns"—By W. G. Schuller, Caterpillar Tractor Co., Peoria, Ill.

"Liquid Phenolic Casting Resins for Foundry Patterns"—By C. R. Simmons, Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y.

7:00 PM—Chapter Officers and Directors Dinner.

Presiding—Max Kuniansky, Lynchburg Foundry Co.

8:00 PM (A)—Sand Shop Operation Course (Session 2).

(Sponsored by Sand Division, Sand Shop Operation Course Committee)

Presiding—E. J. Bush, U. S. Navy Yard, Washington, D. C.

Co-Chairman—E. W. Horlebein, Gibson & Kirk Co.

Subject—*"Your Sand Pile."*

Discussion Leader—W. M. Ball, Jr., Magnus Brass Div., National Lead Co., Cincinnati.

PROGRAM

TUESDAY, APRIL 29 *(Cont.)*

8:00 PM (B)—Gray Iron Shop Course (Session 2).

(Sponsored by Gray Iron Division, Shop Operation Course Committee)

Presiding—W. W. Levi, Lynchburg Foundry Co.

Co-Chairman—C. J. Rittinger, American Car & Foundry Co., Detroit.

Subject—*"Effect of Coke Quality on Cupola Melting."*

Discussion Leader—D. E. Krause, Battelle Memorial Institute, Columbus.

8:00 PM (C)—Inspection of Castings.

(Sponsored by Inspection of Castings Committee)

Presiding—H. R. Youngkrantz, Apex Smelting Co., Chicago.

Co-Chairman—H. C. Stone, Belle City Malleable Iron Co.

"Importance of Radiography to Inspection"—By E. L. LaGrelius, American Steel Foundries, East Chicago, Ind.

"Magnetic Particle Inspection in the Foundry"—By W. E. Thomas, Magnaflux Corp., Chicago.

8:00 PM (D)—Heat Transfer.

(Sponsored by Heat Transfer Committee)

Presiding—H. F. Taylor, Massachusetts Institute of Technology, Cambridge.

Co-Chairman—W. J. Klayer, Aluminum Industries Inc., Cincinnati.

"Freezing Rate of White Cast Iron in Dry Sand Molds"—By H. A. Schwartz, National Malleable & Steel Castings Co.

"Thermal Conductivity of Three Sands"—By C. F. Lucks, O. L. Linebrink and K. L. Johnson, Battelle Memorial Institute.

"Influence of Properties on Solidification of Metals"—By V. Paschkis, Columbia University.

"Feeding of Metal Castings"—By A. F. Faber, Jr., H. B. Salter Mfg. Co., Marysville, Ohio, and D. T. Doll, Case School of Applied Science, Cleveland.

MEMBERS

Are Urged To Obtain Luncheon and Banquet Tickets Early Thus Avoiding Last Minute Worry

C. B. Schofield

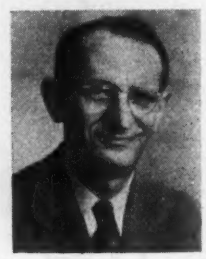
D. L. Radford

E. M. Strick

M. T. McDonough

F. J. Walls

E. C. Troy



David Tamor

E. V. Somers

Max Kuniansky

A. F. Pfeiffer

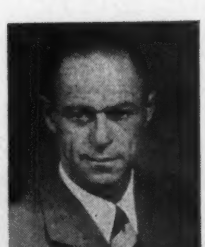
H. E. Flanders

L. H. Hahn

G. Vennerholm

F. C. Cech

M. V. Healey



W. W. Levi

H. A. Schwartz

E. W. Horlebein

J. E. Coon

N. J. Henke

K. E. Rose

H. W. Stuart

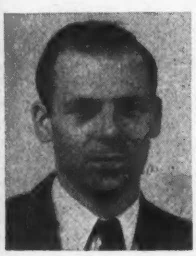
D. W. Gunther

J. H. Schaum

R. T. Wood

F. P. Goettman

R. H. Jacoby



N. H. Keyser

D. T. Doll

Milton Tilley

W. H. Henson

J. H. Van Deventer

N. Janco

G. Sachs

L. C. Minard

G. R. Gardner

PROGRAM

WEDNESDAY, APRIL 30

10:00 AM (A)—Gray Iron.

(Sponsored by Gray Iron Division)

Presiding—B. P. Mulcahy, Indianapolis.
Co-Chairman—H. W. Stuart, U. S. Pipe & Foundry.
"Critical Survey of Foundry Coke"—By D. E. Krause and H. W. Lownie, Jr., Battelle Memorial Institute.
"Thermochemical Analysis of Combustion in a Cupola"—By H. E. Flanders, University of Utah.

10:00 AM (B)—Steel.

(Sponsored by Steel Division)

Presiding—C. H. Lorig, Battelle Memorial Institute.
Co-Chairman—E. C. Troy, Dodge Steel Co.
"Slag Control in the Acid Electric Furnace"—By H. H. Johnson, M. T. McDonough, and D. L. Radford, National Malleable & Steel Castings Co., Sharon, Pa.
"Application of a Single Slag Process to Basic Electric Steel"—By M. V. Healey and R. W. Thomas, General Electric Co., Schenectady, N. Y.

10:00 AM (C)—Sand.

(Sponsored by Sand Division)

Presiding—G. R. Gardner, Aluminum Co. of America, Cleveland.
Co-Chairman—K. J. Jacobson, Griffin Wheel Co.
"Committee Report on New Tentative Standards for Grading and Fineness of Sands"—By R. E. Morey, Naval Research Laboratory.
"The Foundry Sand Laboratory"—By O. J. Myers, Werner G. Smith Co., Minneapolis.
"A Study of the Precision of Sand Test Data"—By R. E. Morey and C. G. Ackerlind, Naval Research Lab.

12:00 PM (A)—Canadian Members Luncheon.

Presiding—Joseph Sully, Sully Foundry Div., Neptune Meters, Ltd., Long Branch, Ont., Canada.

12:00 PM (B)—Brass and Bronze Luncheon.

(Sponsored by Brass and Bronze Division)

Presiding—B. A. Miller, Baldwin Locomotive Works, Philadelphia.
Co-Chairman—R. J. Keeley, Ajax Metal Co.
"Melting of Brass and Bronze"—By H. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh.

PROGRAM

WEDNESDAY, APRIL 30 *(Cont.)*

12:00 PM (C)—Engineering School Graduates Luncheon.

Presiding—F. J. Walls, International Nickel Co.
Co-Chairman—G. K. Dreher, Olds Alloys Co., Southgate, Calif.

2:00 PM—Annual Business Meeting.

Presiding—S. V. Wood, President, A.F.A.
"The Cupola Furnace"—By J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham—CHARLES EDGAR HOYT ANNUAL LECTURE.
President's Annual Address.
Election of Officers and Directors.
Apprentice Contest Awards.

7:00 PM—A.F.A. Alumni Dinner.

Presiding—F. J. Walls, International Nickel Co.
Speaker—John H. Van Deventer, Director of Information, Com. on Economic Development, New York.

8:00 PM (A)—Sand Shop Operation Course (Session 3).

(Sponsored by Sand Division, Sand Shop Operation Course Committee)

Presiding—R. H. Jacoby, Key Co., St. Louis.
Co-Chairman—S. W. Brinson, Norfolk Navy Yard.
Subject—*"The Role of Sand in Hot Tearing."*
Discussion Leader—J. B. Caine, Sawbrook Steel Castings Co., Cincinnati.

8:00 PM (B)—Gray Iron Shop Course (Session 3).

(Sponsored by Gray Iron Division, Shop Operation Course Committee)

Presiding—J. H. Bernard, Eaton Mfg. Co., Vassar.
Co-Chairman—K. E. Davis, Cadillac Motor Div.
Subject—*"Factors Affecting Cost of Cupola Operation."*
Discussion Leader—L. L. Clark, Buick Motor Div., General Motors Corp., Flint.

8:00 PM (C)—Plant and Plant Equipment.

(Sponsored by Plant and Plant Equipment Committee)

Presiding—J. Thomson, Continental Foundry & Machine Co., East Chicago, Ind.
Co-Chairman—E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon.
"Design and Operating Phases of Mechanized Foundries"—By C. O. Bartlett, C. O. Bartlett & Snow Co.

THURSDAY, MAY 1

10:00 AM (A)—Gray Iron.

(Sponsored by Gray Iron Division)

Presiding—V. A. Crosby, Climax Molybdenum Co., Detroit.
Co-Chairman—H. N. Myers, Perfect Circle Co., Hagerstown, Ind.
"The Graphite Phase in Gray Cast Iron"—By R. W. Lindsay, Pennsylvania State College, State College, Pa.
"Metallographic Structure of Silvery Pig Iron"—By R. Schneidewind, University of Michigan, Ann Arbor, and C. A. Harmon, Hanna Furnace Corporation, Buffalo, N. Y.
"Micro-Radiography of Gray Cast Iron"—By J. H. Schaum, E. T. Salkovitz, and F. W. Von Batchelder, Naval Research Laboratory.

10:00 AM (B)—Steel.

(Sponsored by Steel Division)

Presiding—J. A. Rassenfoss, American Steel Foundries, Indiana Harbor, Ind.
Co-Chairman—G. Vennerholm, Ford Motor Co., Dearborn, Mich.
"Occurrence of Intergranular Fracture in Cast Steels"—By C. H. Lorig and A. R. Elsea, Battelle Memorial Institute.
"Segregation in Small Steel Castings"—By H. F. Bishop and K. E. Fritz, Naval Research Laboratory, Washington, D. C.

10:00 AM (C)—Job Evaluation and Time Study.

(Sponsored by Job Evaluation and Time Study Committee)

Presiding—R. J. Fisher, Falk Corp., Milwaukee.
Co-Chairman—J. A. Westover, Westover Engineers, Milwaukee.
"Establishment and Use of Standard Data—(I)"—By M. Annich, American Brake Shoe Company, Mahwah, New Jersey.

12:00 PM (A)—Steel Round Table Luncheon.

(Sponsored by Steel Division)

Presiding—F. A. Melmoth, Glen Lake, Cedar, Michigan.
Co-Chairman—John Howe Hall, Swarthmore, Pennsylvania.

12:00 PM (B)—Patternmaking Round Table Luncheon.

(Sponsored by Pattern Division)

Presiding—H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind.
Co-Chairman—L. F. Tucker, City Pattern & Foundry Co., South Bend, Ind.
Subject—*"Need for Close Relationship Among Patternmakers and Foundrymen."*
Discussion Leader—A. F. Pfeiffer, Allis-Chalmers Mfg. Co.

THURSDAY, MAY 1 *(Cont.)*

2:00 PM (A)—Foundry Cost.
(Sponsored by Cost Committee)

Presiding—R. L. Lee, Grede Foundries Inc., Milwaukee.
Co-Chairman—G. E. Tisdale, Zenith Foundry Co., Milwaukee.
"Two Ways to Make a Profit"—By W. E. George, Booz, Allen & Hamilton, Chicago.
"Foundry Costs and Cost Controls"—By C. E. Westover, Westover Engineers.

2:00 PM (B)—Gray Iron.
(Sponsored by Gray Iron Division)

Presiding—H. Bornstein, Deere & Co., Moline.
Co-Chairman—J. E. Bowen, Chevrolet Grey Iron Foundry, General Motors Corp., Saginaw.
"Effects on Gray Iron of Minor Constituents Derived from the Additions of Copper Alloys"—By K. E. Rose and C. H. Lorig, Battelle Memorial Institute.
"Isothermal Transformation of Molybdenum Cast Iron"—By C. A. Nagler, Wayne University, Detroit, and R. L. Dowdell, University of Minnesota, Minneapolis.
"Reduction in Chilling Tendency Through Silicon Carbide Inoculation of Gray Cast Iron"—By E. A. Loria and A. P. Thompson, Mellon Institute, Pittsburgh and H. D. Shepard, Kerchner, Marshal & Co., Pittsburgh.

2:00 PM (C)—Gray Iron Shop Course (Session 4).
(Sponsored by Gray Iron Division, Shop Operation Course Committee)

Presiding—H. H. Wilder, Eaton Mfg. Co., Vassar.
Co-Chairman—G. A. Timmons, Climax Molybdenum Co.
Subject—*"Variables Affecting Electric Furnace Gray Iron."*
Discussion Leader—K. H. Priestly, Vassar Electroloy Products, Inc., Vassar.

2:00 PM (D)—Sand.
(Sponsored by Sand Division)

Presiding—H. F. Taylor, Massachusetts Institute of Technology, Cambridge.
Co-Chairman—B. H. Booth, Carpenter Bros. Inc., Milwaukee.
"Density of Molding Sands"—By H. W. Dietert, H. H. Fairfield, and E. J. Hasty, Harry W. Dietert Co., Detroit.
"Physical Properties of Molding Sands"—By G. R. Gardner, Aluminum Co. of America, Cleveland.

4:00 PM (A)—Steel.
(Sponsored by Steel Division)

Presiding—J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, Ohio.

PROGRAM

THURSDAY, MAY 1 *(Cont.)*

Co-Chairman—C. K. Donoho, American Cast Iron Pipe Co., Birmingham.
"Determination of Molten Metal Temperatures"—By G. Vennerholm and L. C. Tate, Ford Motor Co., Dearborn.
"Temperature Distribution in Metal Molds"—By M. C. Udy and H. O. McIntire, Battelle Memorial Institute.

4:00 PM (B)—Sand Shop Operation Course (Session 4).
(Sponsored by Sand Division, Sand Shop Operation Course Committee)

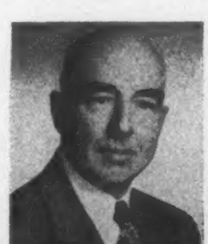
Presiding—E. L. Thomas, Cadillac Motor Car Div., General Motors Corp., Detroit.
Co-Chairman—F. R. Mason, Riley Stoker Corp., Detroit.
Subject—*"Variables in Gray Iron Sand Practice."*
Discussion Leader—C. B. Schofield, Chevrolet Grey Iron Foundry, General Motors Corp., Saginaw.

4:00 PM (C)—Job Evaluation and Time Study.
(Sponsored by Job Evaluation and Time Study Committee)

Presiding—R. J. Fisher, Falk Corp., Milwaukee.
Co-Chairman—J. A. Westover, Westover Engineers, Milwaukee.
"Establishment and Use of Standard Data—(II)"—By M. Annich, American Brake Shoe Co., Mahwah, N. J.

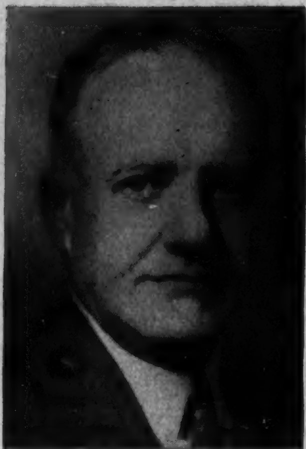
7:00 PM—Annual Banquet.

Presiding—S. V. Wood, President, American Foundrymen's Association.
Presentation of A.F.A. Gold Medal Awards and Honorary Life Memberships.
Speaker—Arthur H. Motley, President, Parade Publication, Inc., New York.
Subject—*"Tradition—An Asset or a Liability."*



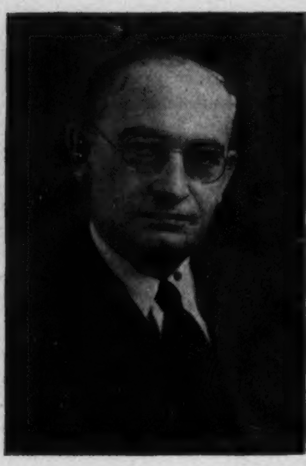
C. R. Wolf

G. E. Tisdale



Henry S. Washburn

The Plainville Casting Co.
Plainville, Conn.



Harry M. St. John

Brass Foundry & Forge Shop, Crane Co., Chicago

Richard A. Flinn, Jr.

American Brake Shoe Co.
Mahwah, N.J.

1947 AWARD WINNERS

To Henry S. Washburn
The Joseph S. Seaman Gold Medal

"for outstanding service to the Association and valuable contributions to the gray iron castings industry."

To Harry M. St. John
The Wm. H. McFadden Gold Medal

"for outstanding work in the field of nonferrous casting research over a period of many years."

To Richard Aloysius Flinn
The Peter L. Simpson Gold Medal

"for outstanding work the past year in the field of chilled and white iron castings."

To Russell J. Allen
The John A. Penton Gold Medal

"for his earnest and unceasing contributions toward the advancement of gray iron technology."

To John Grennan
Honorary Life Membership in A.F.A.

"for long service to the Association, collaboration in technical papers of value to the industry, and for constantly encouraging young men to enter the industry."

To Sheldon V. Wood
Honorary Life Membership in A.F.A.

"as the retiring President of American Foundrymen's Association."

R. J. Allen

Worthington Pump & Machinery Corp.
Harrison, N.J.

John Grennan

University of Michigan
Ann Arbor, Mich.

S. V. Wood

Minneapolis Electric Steel Castings Co.
Minneapolis, Minn.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

DR. JAMES T. MACKENZIE TO GIVE HOYT LECTURE

SELECTION OF Dr. James T. MacKenzie, a director and chief metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., to deliver the 1947 Charles Edgar Hoyt Lecture brings to the Annual Meeting of the Association's 51st Convention an outstanding, internationally known authority on gray iron melting and metallurgy in a discussion of a subject—"The Cupola Furnace"—of economic importance and absorbing interest to the larger segments of the industry.

The lecture will be delivered in the Grand Ballroom of the Book-Cadillac Hotel, Detroit, the afternoon of Wednesday, April 30. It promises to be the scientific highlight of the Congress and a major contribution to the foundry industry's technical literature.

Dr. MacKenzie will discuss, critically, the chemistry of the cupola furnace and the means of control available to achieve desired results; that is, speed of melting, proper metal temperature, chemical composition and physical properties.

The means, Dr. MacKenzie will point out, include the properties of the refractory lining; the construction of the cupola, a factor affecting distribution of the blast; the air itself, with regard to temperature, humidity, oxygen content; the selection of the metal charged—its composition, size and shape; the size, composition and physical properties of the coke; the coke-iron ratio; the height of the bed, and the thickness of subsequent coke charges; the amount and kind of fluxing materials, and the methods of charging the furnace.

The lecture will review the history of the cupola, with particular reference to experiments involving the shape, size, number and distribution of tuyeres; the height and shape of the stack, and the properties of the air blast. These experiments have included such diverse attempts as dry blast, the addition of a water spray, steady blast and heavy pulsations. Dr. MacKenzie will follow the development of the hot blast in some detail and discuss the advantages and difficulties of methods in use or proposed.

A feature of the lecture will be a running comparison of modern practices with the ideas of those great minds of the past generation who interested themselves in, studied and wrote about the cupola furnace. Such familiar names as West, Keep and Moldenke will be mentioned frequently as originators of the best in modern practice and in recognition of their description of the fundamental phenomena.

Dr. MacKenzie's presentation will inaugurate the Charles Edgar Hoyt lectureship series, established by a renaming of the Association's annual foundation lecture to honor C. E. Hoyt for thirty years of "highly valued service to the Association and the foundry industry." Mr. Hoyt retired as A.F.A. treasurer.

The A.F.A. annual lectureship, one of the highest honors the Association has within its power to offer, was founded in 1937 as the Awards Lecture and designated the Foundation Lecture in 1942. The lecturer is selected by the Annual Lecture Committee.

A member of A.F.A. since 1921, Dr. MacKenzie received the Association's J. H. Whiting Gold Medal in 1937 "for important and highly practical work in the advancement of gray iron foundry practice." He has twice presented A.F.A. exchange papers before the Institute of British Foundrymen, and in 1945 made a study of centrifugal casting methods in Germany for the Federal Foreign Economic Administration.

He has a long record of A.F.A. committee service and has been particularly active as the Association's representative on joint committees and on the ferrous metals group advisory to the National Bureau of Standards. He is currently a member of the Advisory Committee of the A.F.A. Gray Iron Division.

A native of Florida, Dr. MacKenzie attended the University of the South from which he received his B.A. degree in 1911 and his B.C.E. and M.A. in 1912. In 1930, in recognition of his "distinguished scholarship and outstanding scientific attainment," the University of the South conferred upon him the honorary degree of doctor of science. In 1946 he was elected a member of the University of the South's board of trustees.

A. H. Allen
President
Detroit Chapter

General Chairman
Detroit Convention
Committee

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A. H. Allen, Penton Publishing Co.

Vice-Chairman
C. E. Silver, Detroit

Secretary
R. E. Cleland
Eastern Clay Products, Inc.

Treasurer
W. W. Bowring
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General Assistant Secretary, Charlotte L. Gorney, Detroit.

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Vice-Chairman, C. H. Miller, Standard Pattern Works, Detroit.
J. A. Alpeters, Crescent Brass & Pin Co., Detroit.
Elmer Blake, Osborn Mfg. Co., Detroit.
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R. J. Wilcox, Michigan Steel Casting Co., Detroit.

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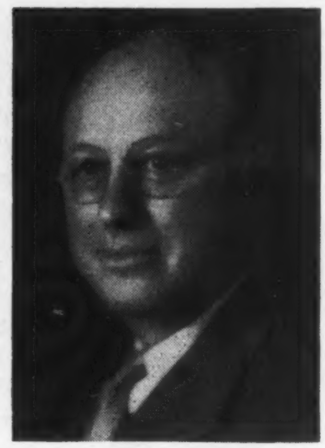

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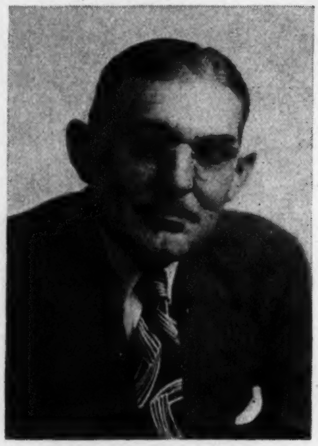

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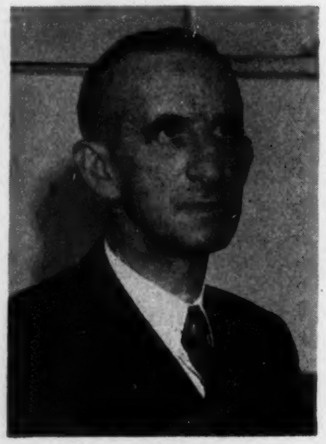

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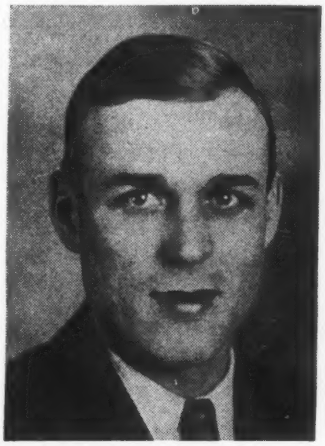


F. J. Dost

R. T. Rycroft

L. C. Wilson

F. J. Walls, immediate past president, is completing one year as a director. He is a member of the Executive and other committees, F. J. Dost, R. T. Rycroft, L. C. Wilson, S. D. Russell and Joseph Sully, elected directors in 1944, are completing three year terms. Messrs. Dost, Rycroft and Russell are members of the Chapter Contacts Committee; Mr. Sully is an Executive Committee member, and Mr. Wilson is serving on the Executive Committee and Board of Awards.

S. D. Russell

Joseph Sully

PROBLEMS AHEAD AS SEEN BY DIVISION AND COMMITTEE CHAIRMEN

GRAY IRON INDUSTRY'S FUTURE

By T. E. Eagan

Chairman, A.F.A. Gray Iron Division. Chief Metallurgist, Cooper-Bessemer Corp., Grove City, Pa.

THE PRESENT UNPRECEDENTED demand for gray iron castings can do much to demonstrate the value of gray iron as an engineering material. It should be clear, however, that in the not too distant future when the cream of today's demand is skimmed and other metals are more available, it will be necessary for gray iron foundries to meet competition or fall back to restricted production. That would be deplorable in view of what can be done in the industry by proper attention to details and initiation of proper controls.

T. E. Eagan

To prepare for the future, gray iron foundries must appreciate the necessity of closer metallurgical control. They must be capable of producing to more exacting specifications as to physical properties. This can only be done by strict metallurgical control of the metal used, which means that greater attention must be given raw materials such as coke, pig iron, and scrap. These should be of proper size, grade and analysis, so that they can be blended and melted to produce the chemical analysis required to attain the physical properties specified. There is available considerable information on how to accomplish this, yet there is need for more fundamental knowledge. For example, there are, apparently, no reliable tests for determining the suitability of coke for cupola operation; hence there is no reliable specification covering cupola coke. The existing specifications for foundry pig iron also leave much to be desired.

In addition to the proper choice and utilization of raw materials, more information on the effect of the chemical analysis and cooling rate of castings on their physical properties is needed. Even the need for a more reliable test bar is becoming apparent.

These things, no doubt, will have to be accomplished without too great an increase in cost to the consumer. This means that the over-all economic picture of the foundry operation must be given considerable attention. Labor saving machinery is almost mandatory. More care and intelligence must be exercised in the proper utilization of sand. Since dimensional accuracy and finish will play a greater part in determining who will get the business, greater attention will have to be given molding practice. To avoid excess scrap, precise gating and risering will be required. Finally, more effective methods of keeping records, such as costs and metallurgical reports, are going to be necessary.

All this seems to express a rather pessimistic attitude. As a matter of fact, however, most of these things are the practice of the larger, more progressive foundries, and the methods used have been published. All that is needed is for the foundry industry, as a whole, to apply existing knowledge to present problems and when rougher weather is encountered it will be ready.

The gray iron industry is one of the world's oldest, yet it has made more genuine progress in the past twenty-five years than in the thousands of its previous history. There are signs that future progress will be much more rapid. It will pay to keep up with the times.

PATTERN DIVISION MOVES FORWARD

By Vincent J. Sedlon

Chairman, Executive Committee, A.F.A. Pattern Division. Pres., Master Pattern Co., Cleveland, Ohio.

ESTABLISHMENT WITHIN A.F.A. of a Pattern Division has proved to be an important step in the technical advancement of the pattern industry.

V. J. Sedlon

The need of the patternmaker for a closer tie with foundries and their personnel has been obvious for some time, particularly during recent years when many foundries became highly mechanized. New molding machinery and methods necessitated changes in the design of pattern equipment. To keep abreast of modern trends it is necessary to become acquainted with them. We must see the new machines, study their performance and know the experiences of their operators in order to make patterns for efficient production.

An opportunity to get acquainted with the men, methods and machines of the foundry industry is pro-

vided by the activities of the Association's Pattern Division. The welfare of either of these industries depends a good deal on the cooperation of the other. Full cooperation on the part of the patternmaker means a sincere effort to make patterns that will give the best possible results with the least difficulty and expense.

A.F.A., organized to promote "the arts and sciences" of the foundry industry, has made, and continues to make through its technical conferences, publications and foundry equipment exhibits, a valuable educational contribution to the patternmaker. In consequence, the patternmaker is better acquainted with the use of his product, and can, consequently, design patterns of increasing usefulness.

A.F.A. Pattern Division meetings are receiving the attention and cooperation of the craft. The interest reflected in attendance at the technical sessions of the Division is an indication of the value of the papers presented. It also indicates the endorsement of the patternmaking industry.

The Pattern Division, organized about three years ago, is justifiably proud of its accomplishments. Six committees have been formed. They are concerned with pattern colors, standardization of pattern supplies, new machinery and methods, the pattern apprentice contest, a patternmaking manual, and permanent molds. Other committees are under consideration and will be formed as quickly as their fields are defined.

MEN MAKE THE INDUSTRY

By Fred G. Sefing

Chairman, A.F.A. Educational Division. Research Metallurgist, Development and Research Div., International Nickel Co., Inc., New York.

THE FOUNDRY INDUSTRY is in competition with other metal processing industries. In order to maintain and advance their industrial position, foundries must prepare to improve every phase of production and sales; enhance metal control; achieve for their products absolute soundness, exact dimensions, smooth and appealing finishes; make economic use of raw materials; keep accurate cost records, and, above all, provide better working conditions.

Fred G. Sefing

These things can be done only with good men. Indeed, the levels to which a particular foundry can go in this competitive industrial picture are dependent entirely on the quality of men making the castings and those in supervisory positions. To be better than other industries, foundries must have better men, men with a greater desire to do a better job, men who have the best training and ability. Finally, the industry must have men for whom the foundry industry holds appeal as a fascinating means of livelihood.

To assist the industry in its effort to have men of the highest calibre, the Educational Division of the Association has prepared recommended procedures for youth encouragement, apprentice training and in-plant training, and for acquiring and training foundry engineers and metallurgists. These procedures will be helpful to individual companies and chapters alike. At the Detroit convention, these plans, and some of the details of their execution, will be discussed at the sessions on "Better Men for the Foundry Industry." These sessions will be of vital interest to all foundry management personnel.

STEEL CASTING INDUSTRY

By C. H. Lorig

Chairman, A.F.A. Steel Division. Supervisor of Research in Foundry Metallurgy, Battelle Memorial Institute, Columbus, Ohio.

THE STEEL CASTING industry has done remarkably well in its transition from a wartime to a peacetime basis. In terms of production, the steel foundry outlook is most encouraging, since a large part of the greater productive capacity built during the war is being used effectively to meet requirements for steel castings. Never before, except during the war period, has there been as great a potential demand for steel foundry products in construction, transportation and many other similarly large fields.

C. H. Lorig

With prospects for a continuing rise in consumption of steel castings there will be a steady demand on the part of both producer and consumer for improved quality of product and for new and better steels. In the progress of the steel casting industry, the properties, soundness, dimensional tolerances, surface appearance, and design of its products have steadily improved. Such improvements must continue, however, in order that the industry may enjoy fully the place it merits in our industrial system. Of prime importance in maintaining its present favorable position and in achieving better quality in steel castings is the need for still closer metallurgical and operating control of metal, raw materials, and molding and casting practices.

Heat treatment of steel castings, involving liquid quenches followed by tempering to improve properties, has made rapid strides in recent years, but this development needs to be extended to make possible production of uniformly high-quality castings covering a much wider range of properties. Low-temperature properties are certain to become increasingly important to the designer, hence foundrymen must learn to incorporate in castings the qualities of low-temperature ductility and toughness whenever the need arises. This can be done only when the metallurgical factors controlling

these qualities are known and when procedures which will permit foundrymen to achieve the objective easily and with assurance have been worked out.

The more exacting physical properties in demand in steel castings are the logical outgrowth of engineering advancements. Not only must one look to the metal for improvements in castings but greater attention must be paid to casting production factors making for greater soundness, improved surfaces, and better design. The effect of surface finish on performance is receiving serious consideration; and demand for better casting finishes will grow as our knowledge of surface effects increases. Steel foundrymen will be called upon, then, to exercise even greater care in the selection of molding materials and molding practices for improving appearance and surface finish. Thus, consideration of the molding sands and their binders and the preparation of new and better mixtures of them must continue to be major efforts of the industry. It is not improbable that radically new molding materials will be found, and even semipermanent and permanent mold casting practices will be used successfully in production on a tonnage basis.

It is natural that the steel casting industry should be confronted with a host of problems generated by demand changes, new applications and by adaptation of castings to fields where previously they had not been successfully used. These problems can be surmounted only by continued use of the best technical and operating knowledge available.

STRESSES FOUNDRY COST ANALYSIS

By R. L. Lee

Chairman, A.F.A. Cost Committee. Comptroller, Grede Foundries, Inc., Milwaukee, Wisc.

IT IS INCREASINGLY apparent that competition will become progressively more exacting in all branches of the foundry industry in the period ahead.

Competition makes proper management an absolute necessity; and one of the requisites of good management is a thorough knowledge of foundry costs. The Cost Committee of A.F.A. has endeavored to outline some of the factors pertinent and essential to satisfactory cost analysis. It is the Committee's conviction that foundries which know their costs will continue in business while those which use the "guesstimator" will quickly end in the industrial graveyard.

R. L. Lee

A.F.A. continues to make available simple cost accounting methods in forms readily adaptable even to the smallest foundry. Their adoption only requires the fitting of them, in minor details, to conditions peculiar to the individual foundry. The Committee is ready and willing at all times to render assistance.

GOOD NON-FERROUS PRACTICE

By D. Frank O'Connor

Chairman, A.F.A. Brass and Bronze Division. Foundry Superintendent, American Saw Mill Machinery Co., Hackettstown, N.J.

THE PRIME OBJECTIVE of every foundry should be the production of quality castings. Castings should meet chemical specification and possess the maximum physical properties of the alloy. To obtain these qualities, it is necessary to establish and maintain closer metallurgical control. The variety of raw materials and ingredients used in the production of castings today makes metallurgical control a "must."

D. Frank O'Connor

Greater research is essential in the selection of foundry sands. We have just scratched the surface of the relative value of sand to coremaking and molding operations, and more thought should be given to the type of sand grain for casting finish and permeability value. The ingredients added to sands for better casting finish, core finish, molding strength and resistance of metal penetration require intensive study for proper application in foundry practice.

The greatest problem confronting non-ferrous foundrymen today is the elimination of porosity in a given alloy. A great deal of this porosity can be traced to poor melting practice, high moisture content in the molding sand, improperly baked cores and gases developed within the mold. Gas producing ingredients should be eliminated wherever possible. Proper supervision, control of core making, core baking, melting operation and sand mixing should be established to eliminate porosity or reduce it to a minimum.

Good progress has been made in reducing porosity and shrinkage by use of the Washburn riser, atmospheric pressure and the application of exothermic powders and gypsum. However, there remains a fertile field in the development of design and size of gating in co-relation with pouring temperatures to reduce porosity.

Many non-ferrous foundries have increased their yield in castings and have maintained closer dimensional accuracy through closer supervision and control. Daily records of production, analyses of defective castings, recording of pouring temperatures and sand tests are essential information for the establishment of good foundry practice and to obtain maximum results.

The development of mechanical equipment and its application to the production of castings in the foundry industry will require constant supervision and maintenance to obtain quantity production and a quality product. Non-ferrous foundrymen can look for greater advancement in this field of the industry in the near future. Good supervision of control will produce a quality product and reduce foundry costs.

ALUMINUM FOUNDRY PROBLEMS

By R. E. Ward

Chairman, A.F.A. Aluminum and Magnesium Division. Chief Metallurgical Engineer, Eclipse-Pioneer Div., Bendix Aviation, Teterboro, N.J.

POSTWAR MATERIAL shortages and scrap metal price increases have had a marked effect on the light metal foundries and, particularly, on the aluminum foundry industry. At the war's end there was available a large aluminum foundry capacity, built up during the war to provide the aircraft industry with high quality castings in great quantities. To convert this capacity fully to peacetime use required many new applications for aluminum castings. New markets, on a competitive basis, was the solution that immediately presented itself to the industry.

R. E. Ward

At first, the outlook was very bright. Good secondary alloy ingot was available at about 10 cents a pound. This low ingot cost permitted making simple castings in permanent mold or mass production sand at competitive prices. The alloys available had properties which for many applications were equivalent to a good grade of ferrous castings. In addition, aluminum castings offered ease of machinability and lightness.

Unfortunately, however, the secondary ingot price has risen to that of primary ingot and, for the present, reduces somewhat the attractiveness of aluminum castings as replacements for those of other metals. In many cases, however, improved machinability, lightness or better delivery dates still outweigh the increase in casting cost. Recent trends indicate a lowering of ingot price, which will improve aluminum's competitive standing. What the aluminum foundry needs is decreased metal cost to strengthen its economic position.

The light metal industry can well be proud of the quantity and quality of the castings it produced during the war period. Since the bulk of the castings in aluminum and magnesium were made to rigid aircraft specifications, the foundries procured elaborate control equipment and operated to produce the finest castings possible. This reputation for high quality is one that must be maintained. It goes without saying that there are many peacetime applications which do not require the same quality castings as aircraft. It would be extravagant to pay extra for best quality if the application does not require it, and it is the duty of the foundry to so advise the customer. On the other hand, deliberate lowering of quality below established standards to increase profit for the foundry or to meet competitive prices is the worst thing that could befall the light metal industry. The use of low-cost, non-specification ingot without thorough metallurgical knowledge of its properties is a definite risk. Such false economy would erase the reputation now enjoyed and would have a lasting harmful effect. If lowering the price of the casting means lowering the reputation of the foundry, the only one to gain is the competitor.

RESEARCH SOLVING SAND PROBLEMS

By Dr. H. Ries

Chairman, A.F.A. Sand Division, Ithaca, N. Y.

IT IS NOW ABOUT twenty-five years since first steps were taken to organize research on foundry sands and their properties. Earlier, a few metallurgists had developed some methods of testing sand properties in connection with the use of that material in the foundry; and we owe much to the encouragement given by the late Dr. Richard Moldenke. He was a prophet, indeed, when, thirty years ago, he made the prediction that synthetic sands would replace naturally bonded ones to a large extent in the foundry industry.

Dr. H. Ries

Early organized foundry sand research, which led to the development of standard tests and sand control, did much for the foundry industry, since it had taken cognizance of the fact that the properties of the sand used in mold or core exert some effect on the character of the casting, preventing or causing defects according to the nature of the mixture. With a sand mixture of the proper quality, uniformity can be watched and controlled by test.

Most of the first tests were on sands at room temperature, and included fineness, green compression, permeability and moisture. As time went on, others, such as deformation and flowability, developed; and these were followed by tests at elevated temperatures, hot compressive strength, hot permeability expansion and contraction, collapsibility, and others.

It has been of the highest importance that these tests be standardized; and specifications have been recommended for most of the room temperature tests. Information is still wanting, however, for those to be made at elevated temperatures.

In this work reproducibility of results is a matter of prime importance and represents a problem to which A.F.A. sand committees are giving much thought. Reference here is chiefly to similar tests made by different laboratories. The trouble, in some cases, may be traceable to methods of sand preparation; in others, to laboratory techniques or to difficult-to-discover defects in testing apparatus.

There remain unsolved problems, but A.F.A. sand committees are studying them. There is an effort to correlate results of laboratory tests on sand at elevated temperatures with overall temperature conditions in the mold. The severe heating the mold gets at the interface and resulting effects are also being probed.

Core mixtures demand special investigation with respect to the effect of different binders, as well as the effects of core gas and moisture absorption.

Apparently the effect of such simple features as texture, grain shape and grain surface have not been explained to everyone's satisfaction. It is sometimes found that two specialists express opposing opinions. As an example, one states that in synthetic sands round grains give greater compressive strength, while another will insist that angular grains provide a stronger mix.

Another problem is preparation of sand for the market. In some areas producers give considerable attention to this matter; in others they are less particular, and foundrymen cannot be certain that they are receiving a uniform product. Coupled with this is the custom of some foundrymen to purchase sand on specification. Although this is desirable within reasonable limits, the consumer should not make his specifications unreasonably strict.

Although all sand problems are not solved, sand control is practiced widely in the foundry industry; and if laboratory results are used intelligently, and checked with results in the foundry, they will be found to be exceedingly helpful.

HUMAN ELEMENT CONSIDERED

By Richard H. Stone

Chairman, A.F.A. Committee on Refractories. Sales Manager, Vesuvius Crucible Co., Swissvale, Pittsburgh, Pa.

THE REFRACTORIES COMMITTEE has emphasized, throughout the year, the importance of educating foundry furnacemen, and others concerned with melting, to a better understanding and appreciation of refractories. Although information on types of refractories, tests, and best applications is not readily available in handy form, it is hoped that a quick-reference manual can be developed in the near future. Such a manual, it is evident, would be particularly helpful to the smaller foundry which cannot justify employment of a refractory engineer on a full time basis.

R. H. Stone

This may be the "year of the yearling." It is certainly the year for application of engineering to the problem which involves creation of conditions likely to attract more workers to the foundry industry to meet the demand for castings. Since refractories, by their nature, are used in those departments of the foundry which have difficult operating conditions, expansion of the use of insulation and improvement of refractories, to reduce frequency and severity of repair and replacement, should help remove the most serious objections of workmen to foundry work. The endeavor might be called the "Human Engineering of Refractories."

TIMESTUDY IN FOUNDRIES

By Robert J. Fischer

Chairman, A.F.A. Job Evaluation and Timestudy Committee. Standards Department, The Falk Corporation, Milwaukee, Wisc.

THE WAR IS OVER; most tax rebates have been made, and foundries are again standing on their own feet. Although many assemblers substituted weldments for castings during the war, the substitution was of necessity; foundries had no competition since their entire output was demanded by the war effort.

R. J. Fischer

Today, however, users of castings are beginning to look around, seeking lower prices and demanding top quality. Many foundries built during the war period have entered the peacetime field. These newer foundries have modern equipment, new buildings and satisfactory floor layouts. What can the older foundries do to meet this competition?

The application of a properly engineered program of work measurement, coupled with suitable wage incentive payments, is a course of action that will give a greater dollar return than any other expenditure. Good plans are now in effect in many foundries. The results are increases in production, an increase in employees' take-home pay, and lower unit costs.

Payment of extra money for extra work is only one of the functions of a standards department. Among its other functions are these:

1. To determine the standard time of all elements of work necessary to produce a finished product. This information is needed to enable management to control operations and to enable the sales department to determine proper selling prices.

2. To supply management, including foremen, with comparative times of manufacture of the various products in production.

3. To determine the relative efficiency of various departments, methods, individuals, and groups of workers in the plant.

4. To furnish supervisors and foremen details of time spent on non-salable work, such as wait-time, set-up-time, non-productive time due to poor working conditions and equipment, and extra time due to departure from standard methods.

5. To give management a means of spotting operating inefficiences in the foundry and throughout the operating organization.

6. To provide a basis for the establishment of standard costs which, in turn, will serve as a basis for accurate pricing in advance of production.

7. To supply information needed in preparing bids for new work.

8. To furnish accurate information for variable labor budgets.

9. To provide the facts and figures needed for good job evaluation.

All these functions cannot be installed immediately after the initial engineering work is done, but they can and should be invested in a standards department as quickly as that group can handle them.

FLUIDITY TESTING

By Howard F. Taylor

Chairman, A.F.A. Fluidity Testing Committee, and Associate Professor, Mechanical Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

KNOWLEDGE OF THE "fluidity" of molten metals is significant to foundrymen in many ways; and not the least important is the bearing this quality has upon the surface excellence of the finished casting. Fluidity, when properly measured, accurately reflects temperature, a quantity hard to evaluate for molten steel, for example, particularly in determining proper tapping times. Many heats of steel have been wasted because of premature tapping. An accurate test of fluidity would prevent this and insure consistent behavior of the metal in the ladle from day to day. An operating test at the furnace for non-ferrous metals would prevent overheating. The effect of alloys on the flowing qualities of metals, whatever their type, is often of importance.

Howard F. Taylor

Fluidity testing actually gives more information than can be obtained from a temperature measurement alone, because the test piece, if made in a sand mold, integrates the effect for all quantities, such as temperature, degree of deoxidation, alloy, and mold composition. It is this combined effect which is of interest to the foundryman in consistently making sound, good-looking castings.

The term fluidity is somewhat loosely used in foundry vernacular, compared with the strict physical interpretation in which it is the reciprocal of viscosity, an accurately measurable constant. Foundry "fluidity" is usually taken to mean the ability of a molten metal to flow smoothly and evenly into a mold cavity and to reproduce faithfully the most minute detail. It is usually measured by the distance a given metal flows in a specially designed flow channel before solidification. A great variety of such flow channels have been proposed but to date none has enjoyed universal acceptance for all metals.

The problems encountered in finding a single test which can be used without modification, whatever the metal, are many, but the Fluidity Testing Committee considers the task not impossible of solution. Last year, past Chairman Clark prepared a British exchange paper on the subject of fluidity in which the spiral flow channel developed at the Naval Research Laboratory emerged as a possibility. The present chairman, having had considerable experience in the use of the spiral, and with faith in it as an accurate testing tool, will propose that in the next year exhaustive tests be made on this, and on any other type that offers promise of utility, in order to arrive at a simple, standard fluidity test for all metals. It may well be that more than one test piece will be required, in which case effort will be made to develop them.

MATERIALS AND MEN

By A. M. Fulton

Chairman, A.F.A. Malleable Division. Vice President, Northern Malleable Iron Co., St. Paul, Minn.

IN THE MALLEABLE iron industry, as in many others, the problem of the war years was manpower. Men who might normally have worked in foundries were in military or naval service or employed in industries temporarily and tremendously expanded.

A. M. Fulton

In the reconversion years the problem became one of adequate supplies of materials, especially pig iron and scrap. One foundryman recently remarked that he would put on fifty more men if he could obtain additional iron to melt. To maintain production, pig iron percentages have been reduced and foundries are using types of scrap normally not considered highly desirable as malleable melting material.

The material shortages have made it difficult to meet the requirements of the many users of castings. Many of the industry's customers are still unable to obtain minimum stocks of cast parts.

The urgent current problems of the industry are those arising from the immediate past. Most striking is the continuing shortage of pig and scrap. Substitutions of normally undesirable types of scrap must continue. In their use precautions must be taken constantly to prevent cumulative increase of such elements as chromium and phosphorus, which, above minimum limits, seriously impair quality.

At the same time, sight must not be lost of the importance of manpower. Otherwise, when melting stocks become more plentiful, the industry may find itself faced with the problem of a lack of men. Forward-looking plans are being completed by the Foundry Educational Foundation to develop supervisory personnel. At least equally important is the problem of obtaining men to work as molders, core makers and in other capacities.

Men should be encouraged to enter foundries to learn to become molders, coremakers, grinders, furnace operators. We should not just seek laborers; we

(Concluded on page 166)

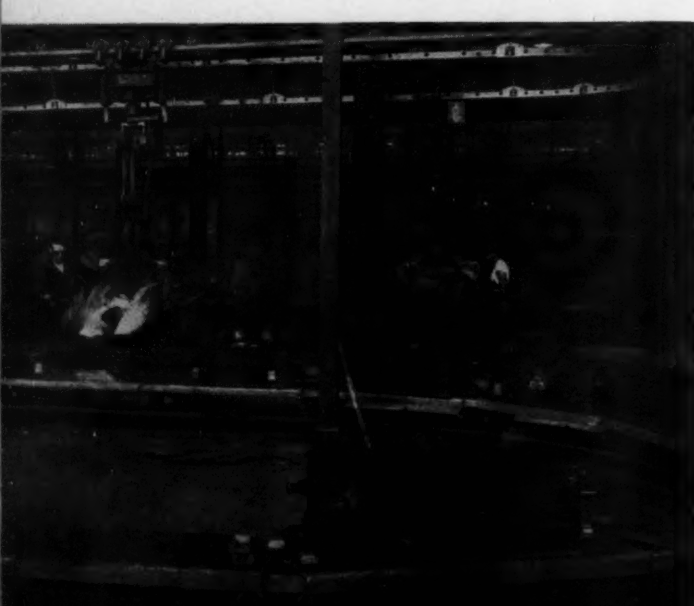
FOUNDRY MECHANIZATION

DESIGN-OPERATION

C. O. Bartlett
Vice President and Director of Sales
The C. O. Bartlett & Snow Co.
Cleveland

Mold conveyor (above) jointed to flex in vertical as well as horizontal plane, thus permitting cars to move up and down slopes to accommodate various levels.

Four-wheel mold conveyor cars (below) supported individually and with tops lapping over onto trucks.



DESIGN AND OPERATION of mechanized foundries embrace many factors. Our observations will be confined, however, only to a few major phases of the general subject of foundry mechanization.

Gray iron foundries, numerically, seem to constitute the largest group currently interested in mechanization or modernization, hence much of this paper relates specifically to that kind of foundry operation. As automotive foundries, because of their high production of repetitive work, offer many outstanding examples of complete mechanization, frequent reference is made in text and illustrations to the layouts of and equipment installed in such foundries.

This should not be interpreted as a lack of interest in the smaller, the jobbing, the steel, the malleable or the non-ferrous foundries. Most of the observations, moreover, are sufficiently general to apply to all types and sizes of foundries. Many an operating or equipment sequence, perfected in some foundry through years of trial and error, will have ready application, with but little further development, in another foundry.

Mechanized Loop

A so-called mechanized loop consists essentially of a line of molding machines, mold conveyors, shakeouts; a conveyor system for returning, screening and storing shakeout sand; mullers, and a conveyor system for distributing prepared sand to molders' overhead hoppers.

Such loops are never identical in any two foundries, and a final layout is agreed upon only after many compromises. No two engineers will make exactly the

Conveyor cars with overlapping tops (below) supported by single, radial action axle, two wheels each.

same approach to a new installation layout and seldom do they select the same location for the sand plants, shakeouts, conveyors and other units. In no case is it ever possible to select, say, catalog layout No. 32, book price it and say "that is it."

Many hours are spent over the drafting board in an attempt to arrive at a layout that will conform to requirements, that can be fitted into the buildings and floor space allocated, and that can be expected to function satisfactorily under the many different operating conditions that prevail in most foundries.

The ideal mechanized foundry has yet to be designed or built. Many valid objections can be raised to almost every layout. Columns, whether in new or old buildings, have a habit of interfering with preferred locations for molding machines, shakeouts, sand plants and conveyors. Column footings, location too frequently unknown, seem always to upset the plans a layout man may prefer. Roof trusses are generally too low for the ideal location of the prepared sand distributing units or for the ideal size or shape of molders' hoppers. Floor space must be reserved for trucking aisles. Already located cupolas, casting cleaning equipment and rooms for core making frequently dictate in advance the only possible location for the loop.

Equipment Funds

The amount of money available has a material effect on any layout or design. Although money has hardly been a limiting factor during the recent war years, the matter of first cost is again with us, and rightfully so. It is well to realize, however, that the combined cost of engineering and installation represents a large part of the total cost of mechanized foundry equipment. This combined cost will remain reasonably constant whether the conveyors be 20 or 30 in. wide, whether a screen be 48 or 60 in. in diameter or whether an elevator has buckets 10x6 in. or 16x8 in. in size.

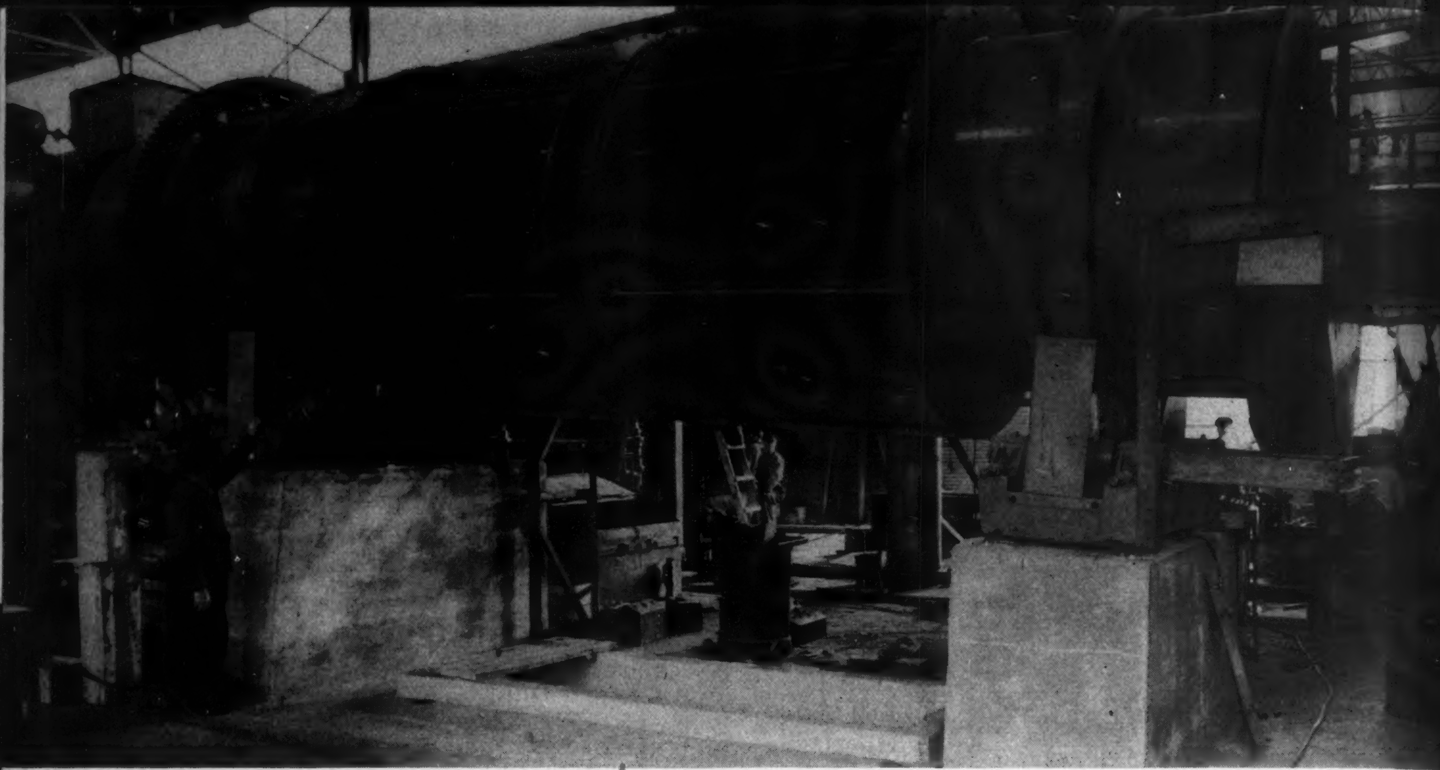
It should be kept in mind that foundry practices or operations are frequently changed during the service of the original equipment. Changes in production or class of castings or flasks or molding machines frequently mean that the units must handle sand at a rate that may be 50 to 100 per cent greater than originally intended.

Today, uncertain deliveries of essential parts is a compromise factor that can be eliminated only in time. Industrial foundry engineers originate or develop overall layout plans and design, detail, fabricate and install conveyor units, storage bins, screens, dust collecting and ventilating equipment. None of these units can function as a whole, however, until such long-delivery items as motors, speed reducers, pulleys, idlers, chain and belting have been shipped and installed. Current demands for steel indicate that the tonnage of shapes and plates available for foundry mechanization will remain uncertain, at least for some time to come.

Terminal (above) rectangular type mold conveyor. All cars are shuttled around entire track, the transfer car at other end being used for return to molding side.

Tilting top type of mold conveyor car (below) facilitates shakeout on snap flask work. Car tops may be made of cast iron, steel plates, or gravity-roll equipment.

Hydraulic or air operated piston drive (below) for slow speeds and intermittent operations. Piston drives are also used on the rectangular type mold conveyors.



Revolving cylindrical screen provides excellent lump-breaking action and can be designed for considerable cooling of the screened sand. Location is important.

Nevertheless, more and more foundries, particularly those handling gray iron, are being mechanized or modernized. Many former employees are loathe to return unless working conditions are improved over those prevailing during the 1930's. Partial or complete mechanization offers one method by which working conditions can be greatly improved and productivity maintained at an increased rate without changes in rates of pay. More uniformity in casting quality and lower scrap losses will result from improvements in sand conditioning, from pouring of hotter metal, and from the increased orderliness that will prevail throughout the foundry.

Molding Machines

Mechanization in a foundry starts with moldmaking facilities. Hence, arrangement and operations of molding machines and slingers must be considered as integral with the layout and operations of all other mechanical equipment. Flask sizes, and molding machine production rates, establish the sizes and capacities of all other units.

Molding machine operators and helpers, under suitable conditions, will maintain, day-in and day-out, an average production of some 100 medium sized flasks per hour per pair of jolt-squeeze-strip machines, or of some 60 to 80 larger sized flasks involving roll-over operations. Neither time nor motion can be wasted around such machines. It is well to remember that, in connection with such production, some 20 to 50 tons of flasks and sand must be handled or lifted during each shift by the machine operators and their helpers.

Molders, helpers and core setters should be provided, then, with the best of equipment and facilities to assist them, in every possible way to maintain uniformly high rates of production. Such equipment includes jib or bridge cranes with air hoists; bails that are light in weight and not tricky; flask trunnions, handles and pins designed for quick, smooth operation; accessible air valves; full air pressure at all times for all services; conveniently arranged overhead sand hoppers; floor gratings for removal of strike-off and spill sand, and a steady return of empty flasks.

High-speed molders may be considered as machine operators rather than craftsmen, but as their working conditions improve with clean floors, good lighting, fresh air and ample working space, and as their auxiliary equipment is improved through careful study and coordination their production will increase.

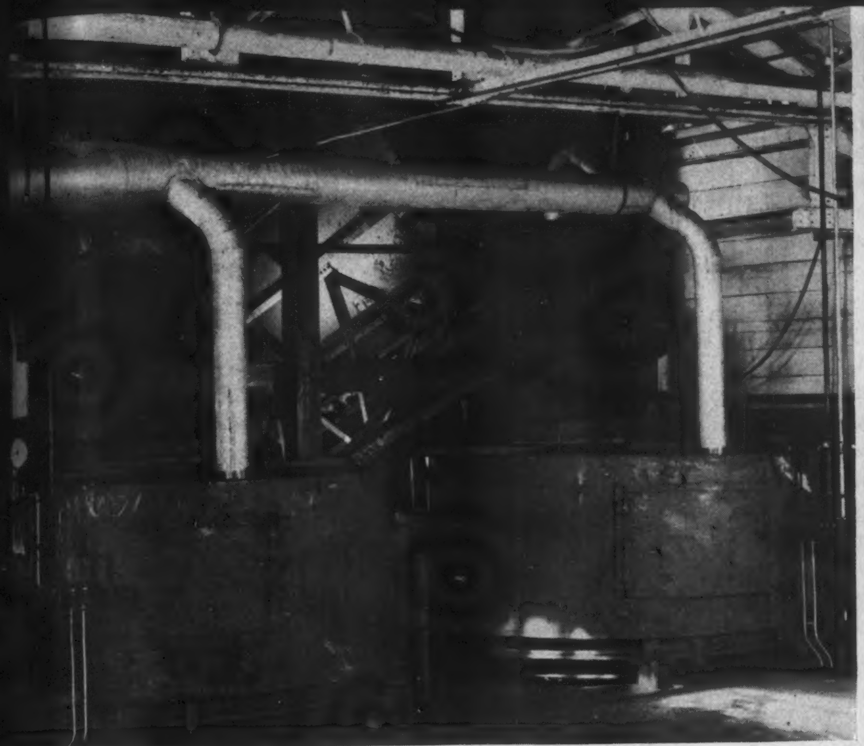
The arrangement and productive capacity of molding machine and slinger set-ups is of prime importance to sand-plant engineers. Decisions must be reached on these points before the design and arrangement of mold conveyors, shakeouts, return flask conveyors, and the entire sand plant with conveyors. Actually, no phase of foundry work can be regarded as an isolated operation when layouts are being prepared for complete mechanization. All phases must be coordinated to function smoothly and in an orderly manner when operating at full rates of casting production.

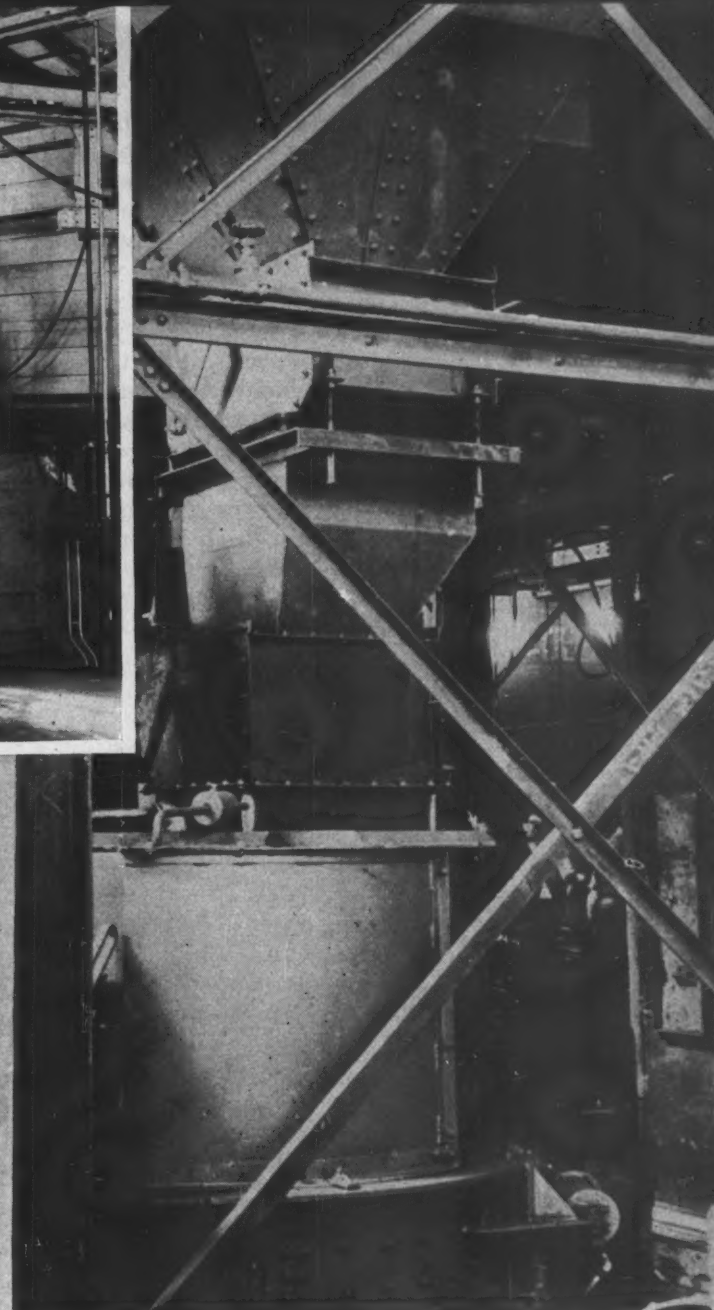
An example of the full value of complete coordination of all units, extending from the cupolas to the shipping dock, is a recently equipped gray iron foundry in which inspected, ready-to-ship castings are loaded into box cars $1\frac{1}{2}$ hr after the iron leaves the cupola.

Mold Conveyors

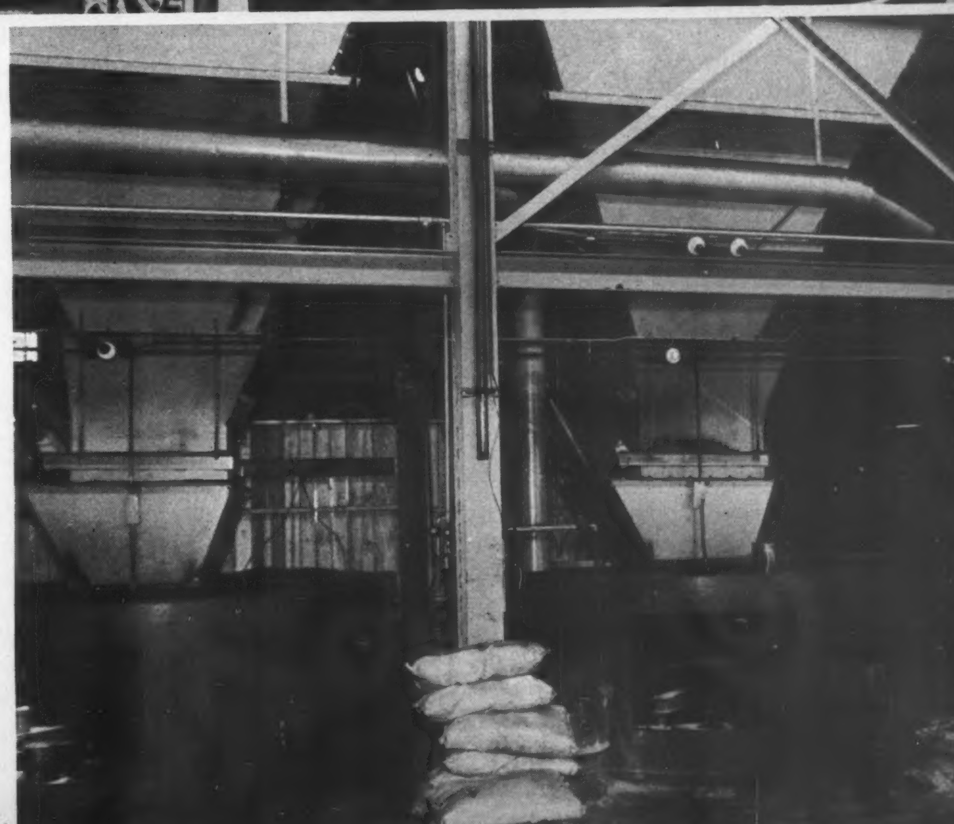
Rammed flasks are set out, cored, closed and poured on either gravity rolls or a continuous, car-type mold conveyor. The use of a car-type mold conveyor localizes and speeds up pouring, centralizes the cooling and shakeout zones, and simplifies ventilation. The conveyor speed is set in accordance with the predetermined rate of molding machine production. Once operating at that speed, whether 6 or 30 ft per min, empty cars are an obvious indication of lost production.

Such a conveyor is truly one of the best yardsticks for





The general arrangement of the entire sandhandling plant is determined by the location of the mullers. If mullers are located above the foundry operating floor level (top), the building roof line must be raised to accommodate them. All bonding materials and sea coal must be elevated for storage in bins or bags on the working platform around the mullers. If the mullers are located at or below the foundry floor line (center and right), pits must be constructed accordingly.



controlling and accurately measuring the productivity of molders. Such facilities provide for the better standardization of work throughout the foundry and enable the establishment of more accurate job ratings. Any car-type mold conveyor represents a dollar-savings investment worthy of careful analysis.

Determining Car Top Size

The size of the car top is determined by the size and the number of flasks to be handled on one car. The overall, or "center-to-center," length of cars is fixed by the shape and size of the tops and the allowable minimum radius of curvature in the track. Although the speed is set by the rate of production, the time required for the cooling of poured flasks is an important factor which affects the conveyor length.

The shape, width and length of such conveyor is always subject to the space required for proper setting and operation of molding machines, floor area available, and the location of building columns. It follows that identical layouts or designs of mold conveyors are not to be found in different foundries; each is tailor-made to suit individual foundry conditions.

When the cars making up a mold conveyor are joined with universal chain, the conveyor will flex in the vertical as well as in the horizontal plane, thus permitting cars to move up and down slopes. The car tops should be at a convenient level for setting out drags. The conveyor track declines before passing in front of the cope machines to provide the same relative height for setting copes and closing. The track then declines to near floor level to reduce the height of flasks for pouring. Once poured, the entire conveyor is dropped completely below floorline to provide clear floor space. Another arrangement of these up-and-down mold conveyors raises the conveyor at the shakeout point, thus minimizing the depth of the customary shakeout pit.

Construction of mold conveyor cars and tops varies with the nature of the work and as new designs may be developed. Each top can be supported individually on four wheels or tops can lap over onto cast iron trucks which are supported by four wheels. Also, tops can overlap and be supported by single, radial action axle using only two wheels per top. They can be designed to move over flat rollers without the use of wheels on tracks. A "sliding-on-rails" type eliminates even the flat rollers.

One development makes use of cars mounted on a single instead of a double track. This type is not continuous in operation and cars are coupled in a series of separate trains. Small locomotives, rather than an endless chain, supply the motive power, and switches are laid out in accordance with needs.

Materials for Car Tops

Car tops themselves may be fabricated of cast iron with bars to facilitate gas venting—heavy steel plates with or without refractory fill, or with gravity rolls. For fast shakeout work on snap flasks, the tilting top offers advantages.

Types of endless chain used in connecting and moving cars vary in design and method of attachment. If bolted to the axles underneath the tops, the chain is usually made up of long pitch, steel side bars with lubricated, steel bushed rollers. Such chain rollers are guided along thrust bars or rail at all curved sections of the track. If the car wheels are straight-faced instead of flanged, continuous double guide bars or rails are provided for the chain rollers along all straight and curved sections of track.

When hinged to the inner side of the car, not underneath, a relatively short-pitch chain is used. This passes around large-diameter sprockets placed at the curved ends of the track. On this type the chain is driven by one of these sprockets. Chains located under the tops are driven by steel dogs that engage chain rollers or other attachments. These dogs are supported in a short length of single or double strand endless chain.

Variable Speed Drives

All continuous drives should provide variable speeds. For rather slow speeds with intermittent operations, the drive may consist of steel dogs mounted on a carriage moved back and forth by means of a hydraulic or air operated long-stroke piston. This piston drive is used on the rectangular type of mold conveyor where movement is limited to one car length at one time. One car is placed on the end transfer carriage, the carriage is moved over and the car moved out onto the back section of track. All cars are thus shuttled around the entire track, using the transfer car at the other end for return to the molding side.

Many troubles associated with the operation of mold conveyors may result from inherent foundry operating conditions rather than from faulty design of equipment. Hot metal runouts, accumulations of sand and rubbish on tracks, or hidden shovels or tools under the cars will result in shutdowns. The mold conveyor is the only piece of equipment in the foundry that handles all flasks, all cores, all poured metal and all sand associated with the production of one loop. It follows that such equipment is entitled to the best of maintenance care and should not be expected to pull through spilled sand accumulations or other obstructions.

When the methods of pouring or other limiting factors preclude the use of mold conveyors of the car type, then several lines of gravity rolls can be arranged to handle the molds and flasks. As gravity roll conveyors are easily moved, any original installation may be changed as needs develop.

Shakeout Installations

Shakeout still is one of the less desirable jobs in many foundries. Dissatisfaction with such work results in more than average flask damage, shutdowns and absenteeism. Proper attention to shakeout arrangement details can eliminate most of these troubles. Experience indicates that shakeouts should be considered as an integral part of sand handling systems, and that careful study should be given to all alternate arrangements before a layout is considered acceptable.

Mechanical shakeouts, although sold as complete units, seldom fit naturally into locations selected. Additional supporting members must be provided over pits. Shakeout sand-collecting hoppers must be fitted under shakeouts and designed with sufficient slope so that the sand will flow onto the conveyors located beneath such hoppers. It is the height required by the hoppers, con-

veyors and transfer points that determines pit depths. The importance of arrangement and details of design of shakeouts should never be overlooked. Alterations and changes are extremely difficult and costly once operations have started.

Real study should also be given at the outset to provision of proper ventilation at every shakeout point. Suitable sidewall or canopy hoods or housings can be designed for most arrangements. The layout man should visualize, however, that such hoods must provide the working space and conditions around the mold conveyor and the shakeout as required for dumping flasks, return of empties and removal of castings—all with or without use of cranes.

Size of flasks and of castings and the numbers to be handled per minute or per hour determine the size, location and number of shakeouts used in connection with any mold conveyor. One shakeout of the mechanical type is frequently sufficient. It is rather common practice to use two, one each for cope and drag. There are distinct advantages in the use of three; one for copes, one for castings and one for drags. Removal of copes shortly after pouring facilitates cooling of the castings, makes for cooler sand and simplifies the return of empty flasks, since copes and drags can thus be handled on separate conveyors. Passing all castings over a separate shakeout removes considerable sand that otherwise would be a source of concern in the cleaning room. In addition, it returns that sand to the system where most of it will be re-used instead of wasted.

Shakeout Sand Conveyors

Usually, consideration is given to layout of shakeout and strike-off sand conveyors only after rather definite locations are assigned to the molding machines, the mold conveyors and the points of shakeout. At this stage the sand-plant engineer is often expected to perform a miracle by arranging, without the aid of pits, penthouses or building alterations, for all shakeout sand to be returned to storage, mulled, and distributed over the molding machines. It is natural that proposal layouts, developed by different engineers, disclose many variations in the arrangement, types and number of conveyor units, as well as in the location and arrangement of the various units of the sand plant itself.

Shakeout sand, with such rods, chills and other pieces of metal that may pass through the shakeout deck, can be handled by any one of several types of conveyors or by a combination of various types. Vibrating feeders or vibrating conveyors offer advantages, if material is to be conveyed for only short distances, if the sand is hot and reasonably dry, or if a desirable minimum pit depth can thus be maintained.

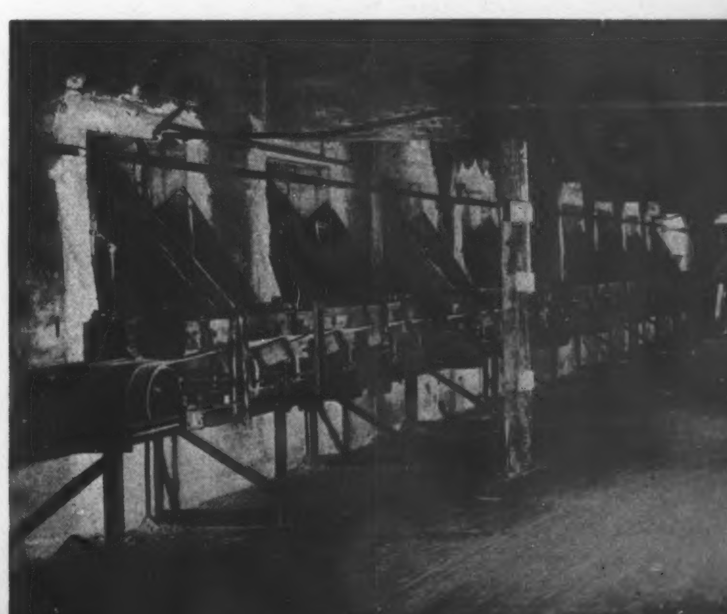
One variation of this all-metal conveyor is the oscillating type which can be used to convey hot materials over relatively long distances. Apron conveyors are commonly used for hot sand, if inclusions of hot metal will burn a belt or if such conveyor must be inclined upward at an angle in excess of 18 degrees.

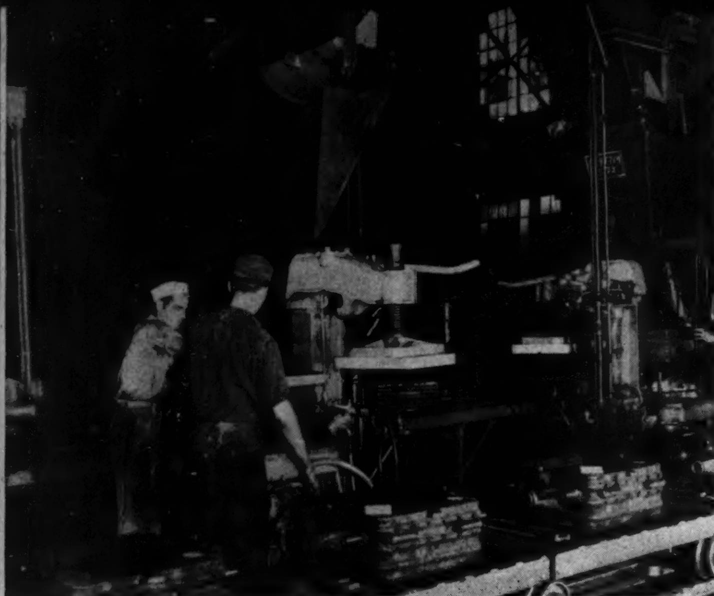
Whenever conditions permit, belt conveyors are pre-

Plows divert prepared sand from belt conveyor into molders' hoppers, and may be hand or air operated.

Belt conveyor distributes prepared sand to molders' hoppers. Belt widths should be not less than 24 in.

Overflow sand may be returned to system through shakeout, or belt conveyor in a pit below machines.





Molder's hopper gates may be operated by hand or air. Vibrating feeders replace the gates in some instances.

ferred. Installation and operating costs for belt conveyors are lower than for aprons, and sand spillage is less. Belts can convey for long distances and a magnetic pulley can easily be installed at the head end to remove tramp iron and other magnetic materials.

The use of heat-resistant belting, fabricated with one or more covers of insulating asbestos, may reduce shutdown time incident to burned belts, but nothing except all-metal conveyors can be expected to stand up when handling sand, rods or castings with temperatures above 400 F. The use of water sprays on belt or apron conveyors for cooling sand has never been satisfactory. It is difficult to balance the amount of water so added with the loading of the conveyor, with the result that the sand remains too hot or becomes too wet.

Cooling Shakeout Sand

An acceptable method for cooling and handling hot shakeout sand and rods is to pass the material directly into a revolving, cylindrical, trunnion-mounted steel shell. Here the proper amount of water to be added for cooling is accurately controlled by the temperature of the air exhausted from the shell. Periodic heavy surge loadings, unavoidable when shaking out large flasks, even out in a rotating shell—the lumps are broken and the sand may be separated from the metal by means of perforated or slotted sections.

All shakeout and most strike-off sand should be screened before storing and mulling. As strike-off sand usually is returned through the same sand conveyor system as shakeout sand, the screen must be selected to handle both tempered and dry sands at a rate that will represent maximum surge loading of both kinds. All screens should be mounted within a relatively tight housing so that air-borne dust can be removed.

Revolving cylindrical or hexagonal screens provide excellent lump-breaking action that results in almost complete recovery of foundry sand. Revolving screens can be designed to provide facilities for considerable air cooling of the screened sand. Such screens can be spider mounted on a central shaft extending through the screen, or trunnion mounted outside the cylinder so that no internal structure interferes with passage through the screen of sand, lumps, rods or gaggers.

From the maintenance man's viewpoint, the location of this screen can be as important as the size and type selected. If the screen is mounted on or near the first-floor level, all sand can be passed through it before handling by a bucket elevator. Thus many shutdowns, normally associated with operation of bucket elevators and screens, can be eliminated. Screened sand is considered ideal for handling in an elevator. Unscreened shakeout sand, with more than occasional lumps, rods and metal that will pass over a magnetic pulley is difficult to handle in bucket elevators. A screen located at floor level is, by comparison, easily accessible for inspection and repair purposes. Furthermore, it comes under the observation of the supervisor in his daily rounds.

Because of floor space limitations it may not be easy to locate the screen at floor level. Hence, it is often supported on top of the storage bin. In such layouts the shakeout sand passes over a magnetic pulley, up an elevator, through the screen and into storage.

The use of bucket elevators in foundries is well-established practice. Floor space limitations and other building arrangements seldom permit substitution of rather long, inclined belt conveyors. Yet, many maintenance men still associate such trouble sources as plugged chutes, digging out boots, cleaning and replacing buckets and re-splicing belts with the use of bucket elevators. In view of their experience and the intimate knowledge these maintenance men have of operating conditions peculiar to their own foundry, their suggestions and preferences should be considered when selecting elevator sizes, designs and arrangements.

Pit dimensions should be such that adequate working space around at least three sides of every elevator boot is available. Similar working space should be provided at every head end by means of an accessible, full sized service platform.

Wet sand will accumulate on the inside walls of an elevator casing if wet, steamy vapors are allowed to condense on the walls. As such sand builds up and dries out, all of it may drop at one time into the boot, thus plug-

Prepared sand for stationary slinger work may be handled by rotary table feeders or apron conveyors.

ging and stopping the elevator. Shutdowns so caused can be eliminated if all steamy vapors and the air-borne dust are properly exhausted. However, daily checks should be made to insure that exhaust facilities are functioning properly.

Storage bins should provide capacity for storing at least that amount of sand required for one hour of continuous operation of all molding machines being served. Twice such capacity is to be preferred. However, in the layout the capacity and the design of storage bins usually is determined or limited by the arrangement of mullers, height and location of roof trusses, size of penthouse provided or travel of an overhead crane.

Storage Bin Design

Shakeout sand may be returned to storage in a relatively dry condition, but more frequently it is on the steamy, moist side. To prevent sand bridging, outlet openings in the bin bottom should be as wide and long as the arrangement of muller feeding mechanism will permit. To minimize "piping" or the hanging up of sand along bin sides and corners, all sloping sides and valley angles should be as steep as design of the overall layout and available space will permit.

To reduce dusting and steaming, all bins should be covered and ventilated. Such covers will serve as walkways or service platforms around any screen or conveyor that may be supported over the bin. Since sand is an excellent insulating material, normal storage will have no appreciable effect on the temperature of stored sand. If hot sand is returned to the bin, then that same sand will be hot when withdrawn.

Stairway to Bins

Access to the top of most storage bins should be by means of a stairway rather than by ladders. Stairways can usually be designed to provide easy access to such units as distributing belt conveyors, aerators, screens and elevators. Provision for such stairways should be made in the original general layout of the sand plant.

Muller feeding mechanism, usually supported under the storage bins, may consist of apron conveyor feeders, measuring hoppers or scale mounted weigh hoppers. Such hoppers may be mounted in fixed positions over the mullers or on a traveling larry car so that sand from any bin may be fed into any muller.

Use of apron conveyor feeders will enable a lower overall height of bin structure and may enable a more even downward movement of sand across the full width and length of the bin. Size of batch to be apron-fed is regulated by the width and depth of a pull-out gate, rate of speed of the conveyor, and time interval of conveyor operation. With continuous mullers, or pug mill type mixers, such apron feeders operate continuously.

Customer preference usually determines the type of mullers that the sand plant engineer fits into the layout. The number and size of mullers to be used, as well as the expected operating cycle for batch mullers, are matters of vital importance. In computing expected performance, it is well to remember that mulled sand will not weigh 100 lb per cu ft, but usually less than 70 lb. Actual mulling time for one batch of gray iron sand will seldom exceed 1½ min, but the time required for the complete operating cycle must include that required for

For rapid filling in large flask work, sand may be handled to advantage by the apron conveyor feeders.

loading and unloading, which will vary according to type of installation.

The use of two medium sized units usually is preferred to that of only one large sized unit. The installation of three units can be justified whenever the capacity of two such units may be considered as borderline. In other words, mullers should have ample capacity so that, at all times, they can supply the molders with all the sand required.

Periodic check-ups should be made of all muller operations. The time required for loading, mulling and discharging should be separately clocked for several cycles. The pounds of sand in several batches, as discharged from the mullers, should be accurately weighed, not just roughly measured or estimated.

Muller location fixes the general arrangement of the entire sand plant. If located above the level of the foundry operating floor, then the building roof line must go up accordingly. If located at or below the floor line, then pits must go down. When located above the floor line, all bond and sea coal must be elevated for storage in auxiliary bins, or in bags on the service or working platform that must be provided around the mullers. Each foundry seems to select a muller arrangement differing from any previously installed.

Continuous type mixers offer advantages in layout and operations when circumstances permit their use. The pug-mill type, first used many years ago, still is preferred in many foundries. A type of more recent design provides mulling action as well as intensive mixing. Sand, bond, sea coal and water are fed continuously into the loading end of such mixers and a steady stream of prepared sand is discharged at the other end.

Prepared Sand Distribution

Prepared sand should be discharged from all batch mullers into surge or temporary holding hoppers so that the mullers can be emptied as quickly as possible and the mulling cycle resumed. Such hoppers are supported directly above a belt or apron conveyor and should be designed to hold not less than one batch of mulled sand.

An adjustable gate is arranged between the continu-

ous skirt plates of the conveyor and at the front of the hoppers. The size of this pull-out gate opening and the speed of the conveyor must be so regulated that each hopper will be emptied before another batch is discharged from the muller. The rate at which sand must be handled by this pull-out conveyor determines the sand-handling capacities for all other conveyors or elevators handling prepared sand.

To improve sand flowability and permeability, an aerator is customarily included in most prepared sand conveyor systems. Irrespective of type, size, design or location, daily inspection and periodic cleanout of such aerators is warranted. Provisions should be made in the layout for adequate and accessible walkways or service platforms on both sides of an aerator.

The design of most prepared sand distributing belt conveyors is rather well standardized. Experience indicates that belt widths of not less than 24 in. can be justified on most installations. A walkway is customarily provided along one side of the conveyor. If the conveyor serves a double row of molders' hoppers, walkways should be provided along both sides. If the walkway plate is widened sufficiently to floor in the area underneath the belt conveyor, it will minimize sand spillage onto molding machine operators and molding work located below the distributing belt.

Sand that passes under the plows and over the head pulley of the distributing conveyor should be returned to the sand system. This overflow sand can be handled in tote boxes, or it may be spilled onto the tops of poured molds and returned through the shakeout. A belt conveyor located in a pit alongside of, and below the molding machines, will provide the most advantageous means for handling such sand.

Such a conveyor should be arranged to return to the system all of the strike-off and spill sand that otherwise would accumulate on the floor around the molding machines and the mold conveyor. The use of a conveyor for the handling of all overflow, strike-off and spill sand contributes much to the good housekeeping conditions that should prevail in every foundry.

Diversion Plow Types

Prepared sand is diverted from any distributing belt conveyor into molders' hoppers by means of plows. The design of hand-operated plows is reasonably well standardized. Single, double or split plows may be used. Plows may be operated by air cylinders instead of by hand. For the remote control of such plows, each air cylinder can be actuated separately through the use of solenoid operated air valves. A recently developed automatic plow makes use of a ribbon screw conveyor arrangement that aerates the sand while removing it from the belt conveyor.

Design of molders' hoppers may involve considerable compromise. The height of molding machines is fixed. The height of the distributing belt conveyor is frequently predetermined by the location of roof trusses. Within such limitations it is often difficult but important to design molders' hoppers with sides that slope at an angle sufficient to prevent hang up of sand and still provide the hopper capacity required for molding machine operations.

Gates at the bottom of molders' hoppers are often of the double undercut type, counterweighted and arranged for hand operation. Use of directional chutes under these gates is frequently necessary. Hopper gates can, of course, be operated by air cylinders and in some installations gates have been replaced by vibrating feeders. When prepared sand is used for stationary slinger work, rotary table feeders are frequently used. Apron conveyors can also be used for feeding slingers. For the rapid filling of large sized flasks, an apron conveyor feeder may serve to advantage.

Acknowledgment

The observations presented in this paper do not have specified reference to the exclusive design of any individual or company, nor are they intended to apply to the equipment of any one concern. Acknowledgment and appreciation is, therefore, extended to all engineers in various firms whose efforts, services and photographs have made possible this discussion of methods for foundry mechanization and modernization.

FOUNDRY COST BUDGET *

FOUNDRY COST RECORDS serve three purposes. They give an indication of past performance. They provide a yardstick by means of which a foundry can estimate more intelligently. And they enable a more accurate forecast of future business by setting up standard costs, production and profits.

In setting up a budget or tentative operating program, closer customer relations are recommended, since at least ninety percent of all manufacturers will also have made fairly definite manufacturing plans for the coming year. By combining the manufacturing forecasts of his customers, the founder can more easily forecast his own operations from the cost-profit standpoint, and, from his own forecast, determine just where overhead and production costs may or must be altered.

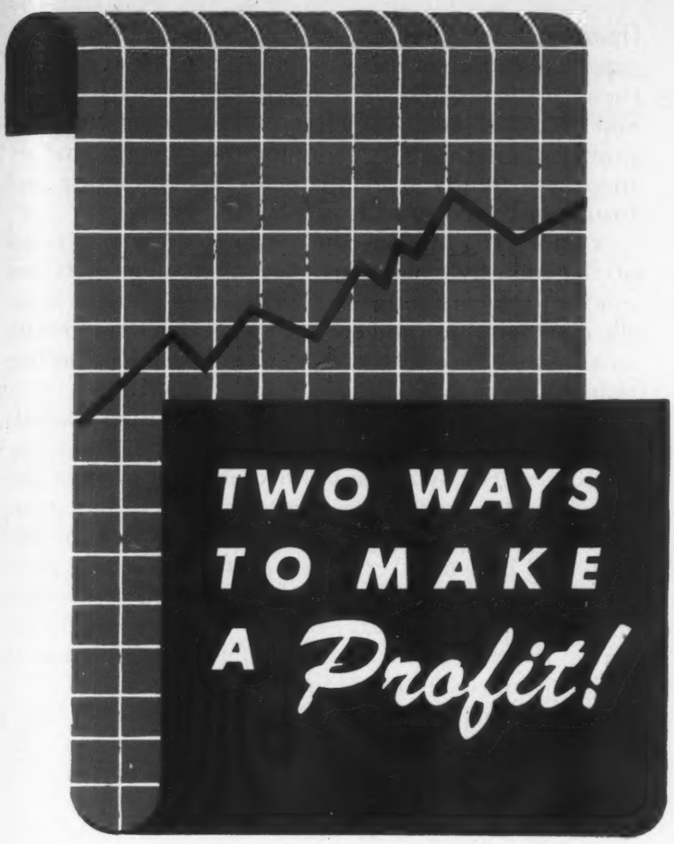
The factors governing use of a simple breakeven chart include: a determination of what should be normal operation in sales volume, or sales volume determined by the prospective needs of customers; poundage based on past cost performance; all fixed charges; metal costs; direct labor costs from past production experience, and variable or controllable costs from records.

By proper application to the chart, these factors enable a forecast of that point where fixed charges will be earned and profits will appear. It will also enable determination of the ultimate percentage of profit which can be obtained over and above the cost items considered.

This sensible approach to foundry costs and operating problems is one in which greater interest is being shown. The ultimate goal of cost budgeting is the goal the castings industry is, or should be, seeking: standard production, standard costs and ample earnings, based on efficient, quality-conscious production methods.

* Abstracted from a paper of the same title presented at a non-ferrous session of the Tenth Annual Wisconsin Regional Foundry Conference, Milwaukee, by J. W. Wolfe, executive secretary, Non-Ferrous Founders' Society, Chicago.

TWO WAYS TO MAKE A Profit!



Wally E. George
Account Manager
Booz, Allen & Hamilton
Chicago

SOME FOLKS MAKE MONEY in business by buying as cheaply as possible and selling at prices as high as the traffic will bear. Junk yard dealers blossom into millionaires by this nondescript approach. It might be a paradox to call it unorthodox.

Some foundries seek to make profit in like fashion. For every one that succeeds by this method, there are at least a score of monuments in the forms of closed foundries and bankruptcies that one can point out. Wise men do not risk their capital on hit-or-miss deals at 20-to-1 stakes unless they are desperately seeking to get rich quick.

Common sense decrees that there must be a better way, one that involves a normal risk at one-to-one odds. Successful foundrymen have found it. Their steady run of profits year after year attests to their having discovered the winning formula.

Determine Costs before You Sell. The better way to profits can be stated so simply that there seems to be a catch in it: Know your selling price in advance. This must be based on known costs and those costs *must* leave a margin of profit. That is all there is to it!

This is easier said than done, but making profit in the tough and competitive era ahead will be no easy task. He who would succeed should employ all the mechanical, manual, and mental skills and ingenuity known to his industry. He who neglects to use all the shop and office tools available becomes an odds-on favorite to fail.

To be sure, some will make profit without any cost system whatsoever. They will operate without the expense, or benefits, as you may look at it, of cost accounting, estimating, engineering or laboratory. The rule of thumb, when coupled with brawn, energy, and skill, has made money before and will make money again. No one would deny such an operation its righteous measure of glory but its return would be still greater if planning and cost control were mingled with those time-honored ingredients.

Costs can be *planned* in advance. They *can* be met if work is done according to plan. Profits on profitable operations can only accrue when volume absorbs all, or enough of, overhead. So volume also must be planned and the required tonnage must be sold.

The profit formula may be reduced to seven elements, each of which is essential to continuing success. These are given as the components in Fig. 1.

Plan for Control. Patterns must be established for a given kind of system. It is necessary to gear control plans to an integrated program so that estimates mesh with the cost accounting and the accounting ties in with budgets for burden absorption. Volume of sales, in turn, must exceed the break-even point. Controls must measure and guide the performance of every key man in your organization and their contributions to a winning team must be acknowledged with extra compensation.

When the whole organization works to a common goal, when the team moves forward along charted pathways, toward known horizons, with the forces of each activity following the forecasted plans of operation, success comes as no accident.

What Kind of a Cost System? Accountants and engineers often disagree with each other, and among themselves too, as to the best form for a system of cost accounting. There should be no disagreement, however, on the principles and the objectives. Foundries, whether large or small, require a system that accomplishes the five points listed in Fig. 2.

One point on the form or objectives of cost accounting should be particularly emphasized. Unless the plan parallels estimating and various controls for expense budgets and profit comparisons, there will be needless duplication of effort. The obvious solution is to design these reporting and control functions in closely correlated fashion to obtain the greatest good at the least cost.

The form and the complexity of a cost accounting plan may not fit any standard mold. The plan should be tailored to the needs, size, classes of work and to the understanding of key executives in each foundry. The latter stipulation is not a casual afterthought. A plan not understood is not used and a plan not used is worthless.

A Case Study in Costs. A little over a year ago a leading foundry came to this realization, to quote the words of its vice president and general manager: "Our estimating system for jobs brought to us by our sales department, we think, is quite outmoded. Likewise, our present cost system is in need of rather complete revamping."

This foundry's original line of products had

Figure 1

ESSENTIAL COMPONENTS OF THE PROFIT FORMULA

1. Have the know-how and the necessary equipment.
2. Supply and apply the requisite energy and skill.
3. Estimate the shop cost by foreseeing how you will do the job.
4. Use a cost system to tell you if you are meeting the estimated cost.
5. Develop a budget plan to project the total cost of any stated level of volume.
6. Employ a sales force that sells enough work to absorb the overhead, at a price that affords a profit.
7. Reward all who serve you in direct ratio to their coordinated accomplishments as a team.

Figure 2

OBJECTIVES OF A FOUNDRY COST ACCOUNTING PLAN

1. To record the cost of manufacturing in a manner adequate for the preparation of the financial statements.
2. To establish a list of cost accounts which renders (1) an accurate segregation of direct costs to product lines and pattern numbers and, (2) classifications of indirect costs arranged for ready distribution as overheads and burdens.
3. To provide a sound basis for estimating normal product costs for sales quotations.
4. To afford a practical means of profit control by providing daily and monthly cost comparisons between the estimates and the actual costs on any or all pattern numbers.
5. To serve as basis for maintaining a variable budget plan which projects and controls costs at all levels of operation.

Figure 3

STANDARD CHART OF ACCOUNTS
(Condensed)

Account No.	Name and Explanation
I. DIRECT LABOR	
100	All direct labor.
II. INDIRECT LABOR	
200	All indirect labor not otherwise coded.
201–3	Charging labor; metal control; tap, line, and slag.
204	Supervisory and clerical.
205–9	Miscellaneous other indirect
210	Overtime and shift differentials.
III. OPERATING SUPPLIES	
300	Lining material.
301–11	Various molding, core, and cleaning items.
312–18	General department supplies.
319	Miscellaneous stores.
IV. OPERATING EXPENSES	
400–3	Power; light; water; heat.
404–11	Various repairs accounts.
412–13	Compensation Insurance and Social Security.
414–30	Miscellaneous other expenses.
431–3	Group, hospital, and fire insurance.
434	Depreciation—general plant.
435	Taxes—general plant.

changed. Gradually the business of making cast iron pipe had swung into a broad line of chemical castings, thence into castings for the automotive, agricultural, and electrical fields. The cost system that once had provided a satisfactory basis for costing pipe and fittings was totally inadequate to the estimating and costing of the postwar lines.

A short engineering study revealed the weknesses of the foundry's old plan. Cleaning room costs and much of the core costs were spread on a tonnage basis; the costs for alloys and special operations were difficult to allocate. Specific profits were more of a conjecture than a known fact.

The late O.P.A. had frozen an estimating formula that followed a restricted pattern and produced irrational results. By oversimplified additions in the estimating system for tonnage costs, for burden absorption, and for gross profit, the direct labor basis of the estimate had become a very small part of the selling price. Three high production jobs were tested to develop this point and the ratio of the selling prices to the direct labor portion of the estimates were found to be, respectively, 9 to 1, 13 to 1, and 35 to 1.

These figures merely verified the general manager's contentions. A new cost accounting plan was indicated, to be tailored to the foundry's need. With it a better estimating plan, designed to put selling prices where they belonged as soon as suspension of wartime regulations would permit, was required.

The new accounting plan was drawn up to meet the five basic objectives. It was tested and revised over a period of two months before its acceptance in final form. In parallel with it, a new estimating plan was outlined and forms designed for estimate preparation. An engineering report at the conclusion of the installation work recorded all the plans and procedures.

Explanation of the Accounting Plan. In a chapter of this report entitled, "Basic Outline of Cost Accounting Plan," the explanations read as follows:

"Cost accounting is the system of putting costs where they belong so that a true picture of unit costs may be built up for management. By the very manner in which costs are reported, segregated, and distributed, a cost accounting plan must be tailored to fit the situation at hand if management is to get the proper and desired portrayal of its unit costs.

"An understanding is essential, therefore, of the component parts that go to make up a unit cost before management can determine the correct alignment and application of its cost accounts. Direct costs must be reported accurately and charged directly to the unit of manufacture. All other costs must be distributed under the accounting plan so that each unit is properly charged with its just shares of the several classes of overheads and burdens.

"A cost accounting plan, in short, becomes a system of collecting costs into accounts and applying those costs to the unit of manufacture by clearly defined methods and formulas."

The outline of the company's new plan of cost accounting included the following topics:

1. Definitions of departmental costs, with clearly drawn distinctions between the productive, the service, and the general departments.
2. A numerical coding for identification and desig-

DIRECT LABOR AND ALLOY COST

PART NAME PART Nº

CARD Nº			NEW P&F		CORE		MOULDING		CLEANING		ALLOYS							
YEAR			EST.		EST.		EST.		EST.		EST.		EST.		EST.		EST.	
DATE	PIECES CAST GOOD	TOTAL	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT	AMT.	UNIT
FWD																		

Fig. 4—Cost card form designed to show direct charges.

nation of the various cost accounts and classifications.

3. Delineation of direct labor classifications.

4. Explanation of the compilation and distribution of melted metals costs, along with alloys.

5. The story of the treatment of scrap losses in the cost of manufacture.

Standard Operating Procedures. A condensed standard chart of accounts (Fig. 3) indicates the pattern of accounting along with the coding numbers set up.

The numerical coding system employed prefix digits to designate the department or cost center wherein the cost was incurred. The code number suffixes identify and classify the type of expense.

The Procedures chapter of the report detailed the steps to be followed in the distributions of direct labor costs, departmental labor, stores charges, cost of melt, and departmental burdens. Outlined also were the preparation of monthly cost-of-production reports, product costs, monthly operating statements, and the treatment of work in process.

Compilation of Pattern or Symbol Costs. The direct costs were to be segregated or recorded by individual pattern numbers. To serve this purpose a cost card was drawn up, as may be seen in Fig. 4. The individual card is identified by the pattern number and provides basic information as to pieces run (total and good), direct labor, and alloy costs. Printed on both sides, this cost card has lines for recording 30 days of operations. For steady production jobs it becomes a monthly cost card. For short runs it is used for a job cost card.

Labor and Material Cost

The card has spaces for all regular direct labor accounts and for the alloys, plus three extra columns for special direct charges of any sort. Item costs for the day are posted and per-piece costs are computed daily and extended for the half-month and the month. At the top of each column is a space for the estimate figure so that the actual and the estimated item costs may be compared at a glance.

This card provides a concise and permanent record of all direct costs on every pattern number. It is readily available for use in completing the whole cost of manufacture for any job, for cost control work, and for re-pricing. The total cost, in comparison with the estimate, may be regularly computed on such specific jobs as the general manager may designate.

Plan for Estimating. With the new cost system installed and working, the third objective could then be achieved, that of providing sound estimates of costs for sales quotations. To make the fullest use of the accounting system, there must be a proper integration of accounting, estimating, and pricing. It is essential, therefore, that the estimating of a job and the subsequent accounting of costs be carried out in close parallel to each other.

The best estimate is one that reflects, in advance of quotation and sale, the best possible cost that can and will be attained when the order goes into the foundry. Direct costs on labor, iron, and alloys must be projected accurately, and without padding, to start the estimate on a proper basis.

The application of departmental overheads, tonnage costs, and plant burden must be on a normal-volume basis. The normal-volume values may not reflect the level of current overheads and burdens, for the latter costs naturally stand as functions of the immediate peak-or-valley condition of the foundry's operations.

Figure 5 shows the Production Estimate Summary sheet. On this sheet the direct labor values are entered first, productive department overheads are applied percentage-wise, per ton costs are added at normal volume levels, and iron and alloy costs are calculated on a yield basis. All plant burdens are included, at normal rates per ton, and finally the estimate for scrap losses is included. This sheet goes from the manufacturing to the sales department where the values for selling and administrative expenses and for profit are added.

This type of estimate summary sheet can be used to compile monthly or job cost comparisons if no other form is provided for that purpose. The five open columns afford room for the original estimate,

Fig. 5—Form drawn for production estimate summary.

Name of Casting________ Pattern Number________

PRODUCTION ESTIMATE SUMMARY

Customer________ Date________

Where & How Made________

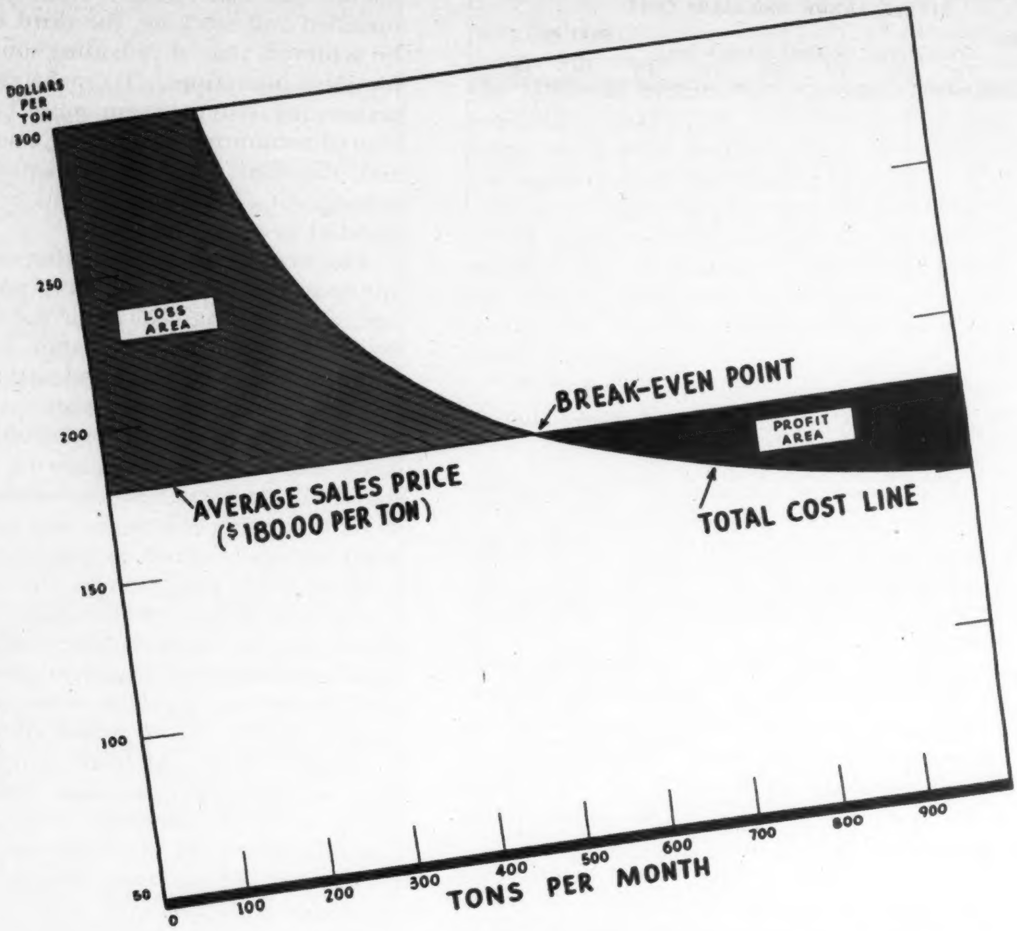
Casting Weight____lb. Total Quantity____ Pc. per Day____ Type of Metal____

		Direct Labor	Department Overhead	Materials	Plant Burden	Total Cost
Pattern Estimate	Total					
Equipment Estimate	Total					
Machining Estimate	Per Pc.					

	Items of Cost	Unit Value	Dates of Original and Revised Estimates				
1	Molding Direct						
2	Molding Overhead	%					
3	Core Direct						
4	Core Overhead	%					
5	Tumbling & Blasting	pT					
6	Cleaning Direct						
7	Cleaning Overhead	%					
8	Special Finishing Direct						
9	Finishing Overhead	%					
10	Iron Cost @ % Yield	pT					
11	Alloy Cost @ % Yield	pT					
12	Heat Treating	pT					
13	Plant Burden *	pT					
14							
15							
16	Plant Cost	Per Pc. Cast					
17	Plant Cost	Per Lb.					
18	Combined Scrap Losses	%					
19	Total Plant Cost	Per Pc. Good					
20	Total Plant Cost	Per Lb.					

Signatures:________ Date Fwd. To Sales________

* Includes Shipping, Pattern & Flask Repairs, and General Foundry Burden.



Break-Even Chart
Showing Cost and Selling Price per Ton
Figure 6

for monthly or job cost comparisons, and for estimate revisions when they are required.

Budgetary Control Plan. Essential to the day-to-day and month-to-month control of costs and profits is a system of variable budgets. These must be so developed that they can be adjusted to compensate for changing classes of work and for the fluctuations in volume. Such budgets tell management in advance what costs should be for varying conditions of operations and enable the manufacturing head to measure equitably the cost control performance of his entire organization.

Variable budgets require an accurate unit of volume by which to measure the activity or work load of the different departments and plants. Best unit, usually, is the time-studied or standard hour of direct labor.

For the foundry without benefit of time-studied standards, either the estimated dollar of direct labor or the ton of castings may be the unit. However, it must be remembered that a ton of flywheels is far different from a ton of cylinder blocks. Therefore, when a ton is the basic unit, budgets may be adjusted by the use of a class-of-work factor.

A practical combination for any foundry to use for the control of time and expense is the comparison of total actual direct labor with the sum of the estimated or standard values. These should be linked with budgeted cost ratios to establish good performance expectancies for departmental indirect labor, supplies, and expense.

These projected ratios become, at normal volume, a part of the estimating formula, as has been previously mentioned. For control purposes, however, the periodic comparisons must be made to the actual volume level instead of the normal.

All items of plant-wide costs and burdens are as susceptible to budgeting as are the costs of the principal producing departments. Circumstances dictate that some costs are fixed and others, such as salaries and research, are essentially controlled by top management. But they may be determined in advance and accurately budgeted to any volume.

The total dollars of sales may be broken down or budgeted into items of plant cost, selling and administrative expense, and profit or loss. Profit or loss is the right term, because the variable budget may as readily project the expected costs below the break-even point for volume as above it.

In fact, detailed expense budgets should be established to cover the entire area between 30 or 40 per cent of capacity and 100 per cent or full capacity. If it develops that a profit can be made in the range between 40 and 50 per cent, it indicates that foundry costs are well under control.

Examples of the break-even or profit charts may be exhibited in two ways. Figure 6 is on a cost-per-ton basis and shows the total cost curve dropping from a peak cost value for low volume to cross the average selling price line at a break-even point of 50 per cent and on to a satisfactory profit in the higher ranges of production activity.

Figure 7 utilizes the profit-graph method of displaying projected profits. It shows the total dollars of sales finally catching up, as volume increases, with the

total dollars of cost at the 50 per cent mark. The upper section in black depicts the profit area.

Use Budgets for Supervisory Bonuses. The canny Scot, Robert Burns, must have had budgets in mind when he wrote, "The best laid schemes o' mice and men gang aft a-gley."

Budgets serve better as an incentive base than as a whip. Of themselves, they are not self-restricting. They serve as a guide but not as a panacea. But when coupled with a pay-off plan that rewards the supervisors for meritorious control performances, by sharing the greater-than-budgeted profits, budgets have a far better chance of success and far less possibility of going "aft a-gley."

Bonus funds should be provided by setting aside from 25 to 50 per cent of the extra profits realized by the collective attainment of cost reductions beyond the budgeted cost levels. Budgets to be used thus must be carefully set and must first provide a satisfactory and substantial profit at normal volume. Further, they must be projected down through a break-even point at a volume level where breaking even would be a distinct accomplishment.

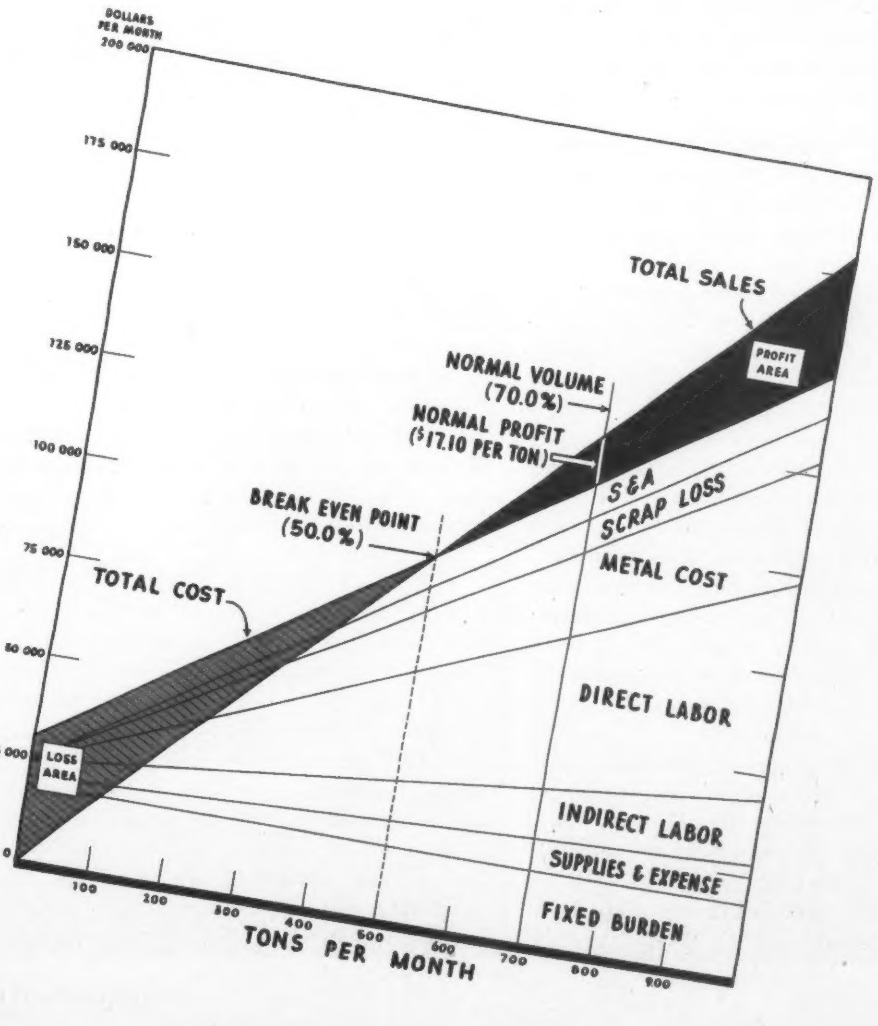
If the contemplated bonus is only for the plant supervisors and the office heads who serve them, the plant cost budgets may be separated from the overall or profit budget. Profits in this way need not be discussed with the shop. Instead, the supervisors may know the expected cost for any level and class-of-work combination and they collect their due share whenever the actual costs are lower than the budgets.

Bonuses may be applied departmentally or plant-wide or in a combination plan which embraces both. Budgeting must always be done by separate accounts and all expense accountability must coincide with control responsibility. Be wary, though, of a straight pay off plan for each separate department. Teamwork is a magic ingredient in the profit formula. If bonus plans are carelessly handled, the melting, the core, and the molding departments may make great showings while the cleaning room becomes burdened with castings impossible to finish satisfactorily.

Control of Defective Castings. In the matter of defective castings, the bonus plan must penalize and reward for the showing in the scrap record. Scrap losses may be budgeted as readily as they can be segregated as to causes and to department inefficiencies. Daily scrap reports, segregation analyses, and comparisons to scrap bogies, are important steps in licking the scrap losses. Every reduction in scrap is pure gain.

The scrap costs in a plant may well be so great that a full-time man of assistant superintendent stature can be profitably assigned to the problem. His day-to-day efforts conceivably can take 30 to 60 per cent off the cost of defectives if he is the right sort and gets the right backing. Before rejecting this idea, a check to see what scrap losses really cost in total for 1946 should be made.

The problems of making good castings at the right cost and selling them for a profit will always be with the castings industry. Cost control is never done, but with all the simple and tested tools of control at work, management may rest assured that there is a far greater chance of making profit.



Profit-Graph
Showing Monthly Costs, Sales and Profits
Figure 7

MALLEABLE FINISHING

Earl Strick
Finishing Supt.
Erie Malleable Iron Co.
Erie, Pa.

FINISHING OPERATIONS on malleable iron castings have sometimes been regarded as a necessary evil and neglected accordingly. Actually, they are an important consideration in the production of good, salable castings and have an important bearing on costs.

There is a tendency on the part of many foundry and pattern superintendents to regard the molding of castings with only two objectives in mind—high yield and low scrap loss. They pay too little attention to finishing. The removal of excessive and misplaced gates, feeders, crack strips, core fins and parting lines are the problems left to the finishing departments to solve as best they can. Many of these operations are performed at an excessive cost which could be reduced by greater co-operation between pattern, foundry and finishing sections.

Unnecessary finishing operations are sometimes caused by the unfamiliarity of the designing engineer with foundry techniques. His chief interest lies in the ultimate use of the casting. Therefore, it is the foundryman's responsibility to try to reconcile the customer's requirements with sound foundry practice.

When a print of a new job is received, it should be submitted to the foundry, pattern and finishing departments for thorough study. Based on this study, a cost estimate of the job is prepared from which the selling price is established and a quotation given the customer. If accepted, an order follows and the pattern and other equipment is constructed.

The pattern with temporary gating is first used by the foundry to produce sample castings. Careful examination of these samples reveals conditions which must be corrected and the job is resampled and the process repeated often enough to get the best possible results.

Subsequently, a sample casting is sent to the customer for his inspection and on receipt of his approval, the job is put into production.

It is important that the chief inspector obtain from the customer full finishing specifications. These would include information on the ultimate use of the casting, tolerances, locating points, sequence of machining operations and other details.

It often happens that castings are given unnecessary finishing due to a lack of information concerning the requirements of the customer. If in doubt, the foundry should always consult with the customer and, if possible, should obtain written confirmation to avoid any later misunderstanding.

Hard Iron Cleaning

Control of the finish on castings does not start in the hard iron cleaning department as many believe. It commences with the molder and much depends on the sand, the facing, the ramming, the pouring and many other considerations. With certain castings, gates must be knocked off hot and on many they can be so constructed that the gates can be knocked off with a minimum amount of stock left for grinding.

There is always considerable controvery relative to the advantages of cleaning castings in the hard iron state, and there are good arguments for and against this practice. In a jobbing foundry with a wide

Light malleable iron castings are hand straightened, inspected, gaged and bagged in this department section.

variety of castings requiring close tolerances, gauging, and an exceptionally good appearance, cleaning in the hard iron is essential. On long running jobs, after the foundry has produced many good castings with low scrap loss, cleaning of hard iron can be discontinued.

Obviously, effective cleaning of hard iron depends on the proper choice of cleaning equipment. Improper equipment or careless handling will result in cracking and breaking of castings because of their brittleness at this stage of their manufacture.

Hard Iron Inspection

Another argument for cleaning hard iron results from the fact that many customers receive daily reports of good castings molded and plan their production schedules accordingly. If, subsequently, deliveries are delayed due to the scrapping of castings discovered defective only after they have gone through the annealing process and other finishing operations, it tends to make the customer dissatisfied. Furthermore, the cost of all of the finishing operations on such castings is a complete loss to the foundry.

Hard iron can be cleaned by tumbling, wire brushing, water, shot and sand blasting. The method which shows the lowest cost for the type of work being produced should be the one selected. One method may prove more productive with higher equipment maintenance and lower labor cost while another may be lower in maintenance and higher in labor cost.

After castings have been cleaned, they are inspected and chipped in the hard iron inspection department. This function, in the opinion of the writer, is one of the most important of all finishing operations. The hard iron inspector must be familiar with defects such as slag holes, sand holes, cold shuts, misruns, shrinks, cracks, hot tears, roughness and other defects. He must be able to determine soundness of a casting by tapping it; must observe whether the correct cores have been used; must continually break castings to insure soundness; and know where to look for sub-surface gas holes.

The pattern, molding and coremaking departments must be kept informed as to all defects which cause castings to be scrapped or which require extra finishing to salvage them. One method which has been found to be helpful has been to sort and lay out all scrap daily so that the molding and core room supervision (and the operators, if necessary) will have an opportunity to see and analyze it.

Wherever casting sections will permit, fins and crack strips should be knocked off to keep down grinding and chipping costs. Excessive and misplaced gates and feeders require extra finishing and should be brought to the attention of the personnel concerned for study and correction. By careful vigilance, the hard iron inspection department can be of great help to all departments.

Grinding. Light gates, feeders and fins can be removed by grinding in hard iron but there are certain objections to this. These objections include low production, high grinding wheel costs, breakage hazards and grinding heat checks incident to the grinding of too large gates, feeders and fins. For that reason, malleable iron castings are usually ground after annealing.

Determining Grinding Method

There are many methods of grinding hard iron or soft iron. Different type fixtures, pressure bars and other considerations based on the design of the casting usually determine the best grinding method.

Grinding machines, stand or swing, of proper speeds are most essential and they should be equipped with motors of ample horsepower so that there is no appreciable deceleration even when pressure bars are used. To obtain best grinding wheel efficiency, recommended peripheral speeds should be maintained.

Light malleable castings are ground on stand grinder.

Swing grinding does job on heavy malleable castings.

There are two types of wheels commonly used in malleable foundries. Both are tested by the wheel manufacturers at much higher speeds than are called for by state safety codes. The recommended maximum speed of vitrified or low speed wheels is 6500 surface ft. per min., while that of the resinoid, bakelite and rubber high speed wheels is 9500 surface ft. per min.

Low wheel costs and maximum production are obtained by maintaining these speeds as the wheels wear. This can be accomplished by an increase in the RPM as the wheel becomes smaller in circumference. Variable speed grinding machines are ideal, of course, but very good results may be had on other grinding machines by changing pulleys after about every four in. diameter of wheel wear, or by changing the wheels from one machine to another of higher spindle speed so that maximum surface speed can be maintained.

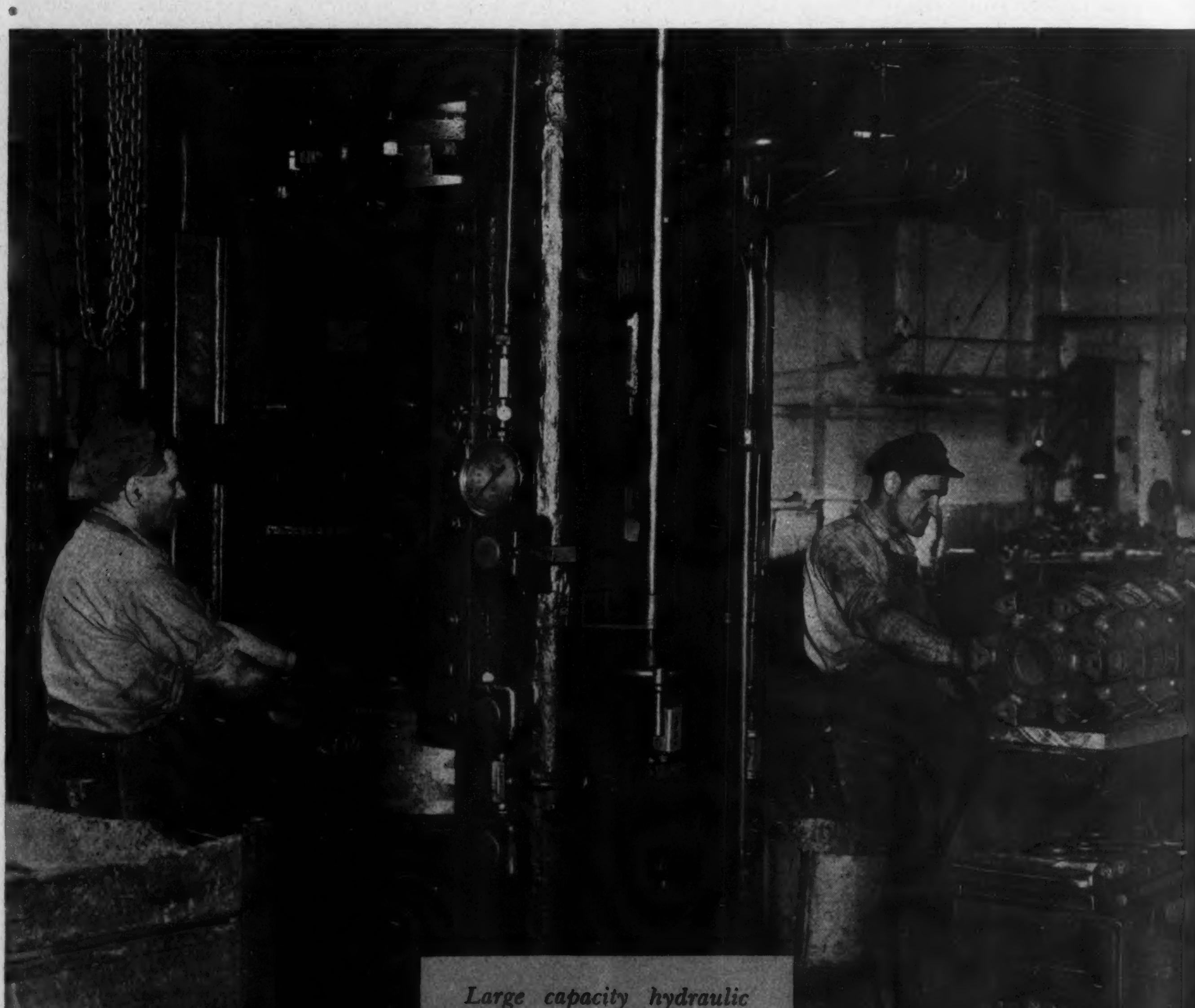
In order to make a comparison between any two types of grinding wheels, the following information should be obtained from the operating data:

Make of wheel; type of wheel; size of wheel; grade of wheel; price of wheel; number cubic inches available for use (full size until discarded); cost per cubic inch of wheel; diameter of wheel at start of test; diameter of wheel at end of test; cubic inches used on test; cost of wheel used on test; number of pieces ground; piece rate per hundred; earnings of operator per hour.

A careful comparison of the cubic inches of wheel (or weight) used, operator earnings and other elements should determine which wheel would be most economical. There are, of course, many variables, such as type of stand, grade of iron, whether or not pressure bars are used, and other considerations.

In comparative tests of different wheels, the same type of casting and the same operator should be used. The amount of metal removed by weight is a further indication of wheel efficiency. Of course, proper safeguards and dust removing equipment are important factors in any grinding department.

Shearing. Gating removal by shearing is quite effec-



Large capacity hydraulic press with proper die equipment does an efficient job of straightening malleable castings to close tolerances thus reducing machining.

tive but usually is adaptable only where quantities are substantial and justify the cost of the fixtures involved. The size and location of gates are very important if shearing is contemplated and considerable attention should be given to the design of fixtures and shearing tools if this operation is to be successful.

Ordinarily, less skill is required for this operation than for grinding and this may often be a determining factor. Iron recovery is also one of the advantages of the shearing operation.

Chipping. Due to the design of certain castings, the gates, feeders, parting lines and other projections are located where they cannot be removed either by grinding or shearing. This entails a chipping operation which is expensive at best and everything possible should be done to hold it to the minimum.

Skill and Equipment Required

Chipping requires considerable skill and universal fixtures to hold the work in a given position are desirable. Air operated vises mounted on a suitable table are very generally used and a small, portable air-operated grinding wheel is an essential supplement to the chipping equipment.

Soft Iron Cleaning. The cleaning of malleable iron in the soft, ductile state after annealing and after grinding is of utmost importance because in this operation all scale and sand adhering to the casting which might prove detrimental in subsequent machining or galvanizing is removed. Modern methods permit castings to be cleaned so that they can be machined more efficiently with longer tool life and with some reduction in time necessary for subsequent cleaning incident to galvanizing and plating.

The equipment used for the cleaning of soft iron is generally the same as that mentioned in connection with hard iron cleaning.

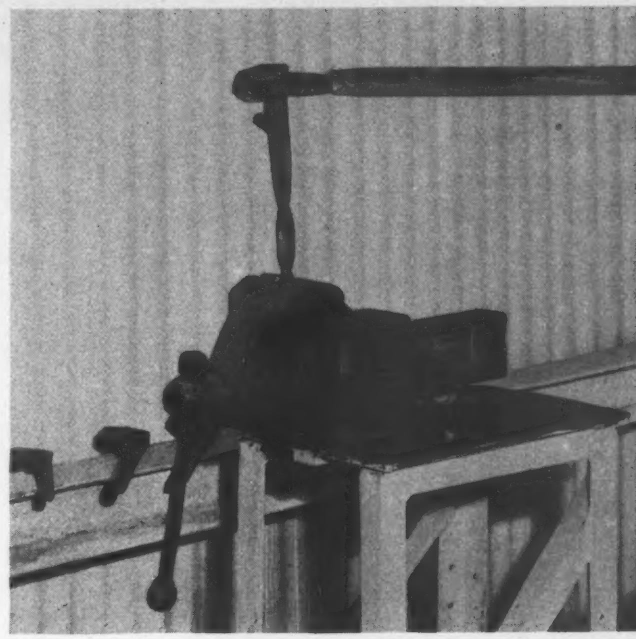
Straightening and Inspection. After cleaning, castings are straightened and inspected. Soft, ductile malleable iron lends itself to hand or die straightening where a high degree of uniformity is desired. This quality permits close tolerance straightening and consequent reduction in casting finishing and machining operations. Today, hydraulic presses of large capacity with very efficient die equipment are performing coining and pressing operations to tolerances previously deemed impossible. This has manifold advantages for the foundry and the purchaser of castings.

Die Design and Construction

An important corollary to all of this is the design and construction of dies which constitutes a comprehensive technical subject in itself. No attempt will be made to cover this subject here except to say that it affords a wide field for engineering ingenuity and large potential savings.

Other methods of straightening malleable castings include the use of slow speed presses without dies, hand straightening on the bench or plate with soft hammers, and drop hammer straightening. Every effort should be made to avoid hand straightening operations as these usually require skill and are slow and expensive.

Obviously, straightening is closely related to the packing of castings for annealing—the better they are packed, the less warpage to be corrected. Considerable straightening can be avoided by careful packing prior to the anneal although in some cases this consideration can be ignored and a properly constructed die depended upon to straighten *all* castings.



Torsion test made on pearlitic malleable iron casting.

Final Inspection

The final operation in connection with finishing is a piece inspection for which carefully trained personnel is required. Certain imperfections which are not apparent in the earlier processing or as a result of that processing, such as cracks, bad grinding, shearing, chipping, improper straightening and cleaning, burnt castings and metal defects should be detected at this point.

In many cases, it is necessary to ream, broach, drill or perform certain tests and other simple operations just before this final inspection takes place. Here, again, is indicated the necessity for close liaison with the customer and a wide knowledge on the part of the inspection department as to the customer's requirements.

Inspection as a function should be entirely divorced from any other operating functions and the chief inspector should report to general management or to a general superintendent rather than be under the jurisdiction of the foundry or finishing departments.

This sets up a function which can be quite independent and impartial, both of which are essential in the inspection operation.

Conclusion

Malleable iron because of its toughness, ductility and extremely high machineability has a wide industrial use. This results in a great range of types and sizes of castings so that, particularly in the jobbing foundry, it is necessary to generalize on the subject of finishing operations. A study of each casting must be made to arrive at the best combination of finishing operations.

There are no hard and fast methods which can be put down as being the best so all one can do is to hope that these thoughts and suggestions which are the results of experience may be helpful to others.

BASIC ELECTRIC STEEL

SINGLE SLAG PROCESS

In a comparison of molybdenum alloy sand castings of basic open hearth and basic electric steel, it was noted that the basic open hearth product had certain desirable metallurgical characteristics that were absent in the basic electric product made by the double slag process. Improvement in basic electric steel was accomplished by thorough boiling and the elimination of the reducing slag.

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AN APPLICATION in the plant with which the authors are associated requires a considerable number of medium to large sized molybdenum alloy castings which are made from either basic electric or basic open hearth steel. A brief comparison of basic electric with basic open hearth steel castings follows. The castings from basic electric steel usually have been made in the Schenectady foundry of the company. The castings from basic open hearth steel have been purchased from an outside vendor.

The castings made in the foundry of this company have been of metal from a six-ton, Heroult-type, basic lined furnace. Charges have varied from 22,000 to 30,000 lb. The steel making process used was the standard double-slag process in which a short boil was obtained lasting for probably 15 to 20 min. removing possibly 0.10 to 0.15 per cent carbon.

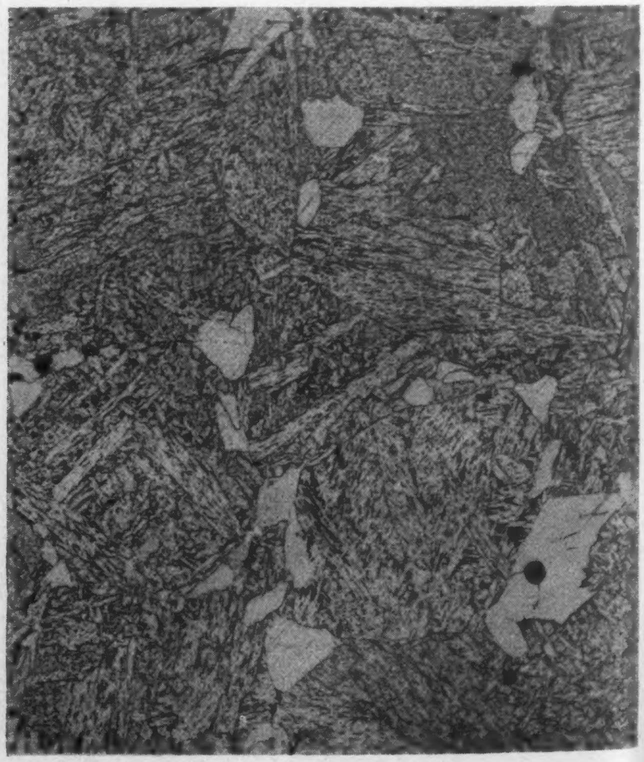
The use of aluminum has been prohibited in the manufacture of the steel for these castings. The heat-treatment applied consisted of a normalize and draw. An acicular structure of three to four ASTM grain size was desired.

In routine checking of microstructures of attached test bars and in surveying the castings generally, the following was noted:

a. The basic open hearth product invariably attained the desired grain size on being heat-treated at 1742 F (950 C). Heat treating at 1922 F (1050 C) gave a proportionately larger grain. Figures 1 and 2

Fig. 1—Basic open hearth molybdenum alloy cast steel. Heat treated at 1742 F; 2 per cent nital etch. ×100.

Fig. 2—Basic open hearth molybdenum alloy cast steel. Heat treated at 1922 F; 2 per cent nital etch. ×100.



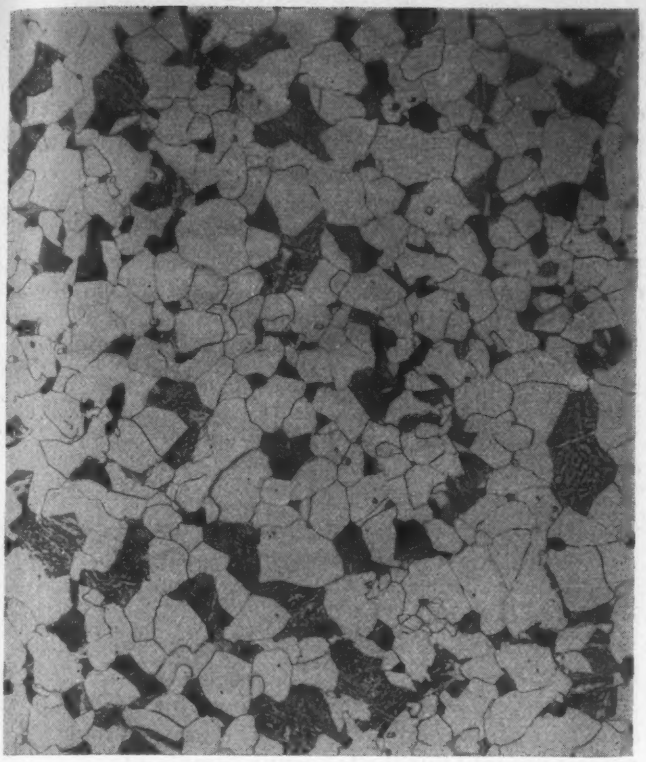


Fig. 3—Basic electric molybdenum alloy cast steel produced by double slag process—20-min boiling period. Heat treated at 1742 F; 2 per cent nital etch. ×100.

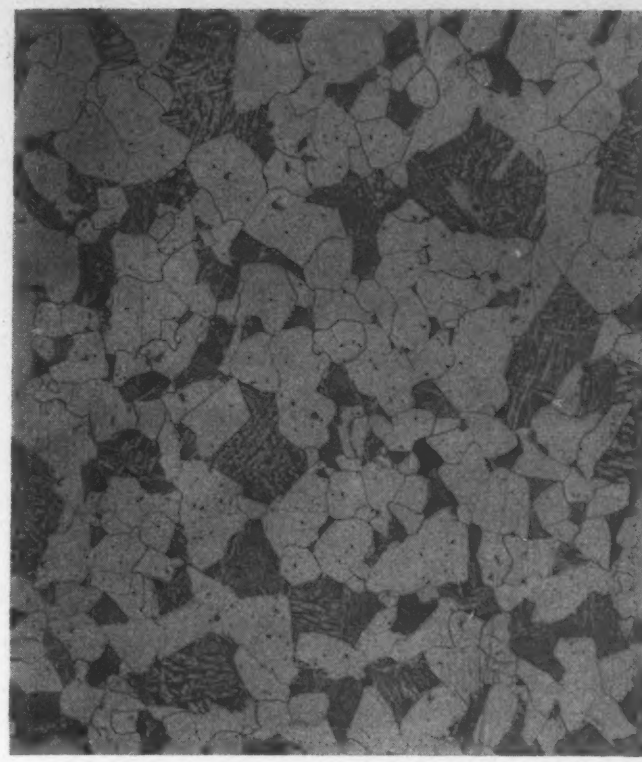


Fig. 4—Basic electric molybdenum alloy cast steel produced by double slag process—20-min boiling period. Heat treated at 1922 F; 2 per cent nital etch. ×100.

are typical microstructures of the open hearth steel.

b. The basic electric product made by the double slag process, generally, was nonuniform and had a grain size much finer than was desired even when heat-treated at 1922 F (1050 C). Figures 3 and 4 are typical microstructures of this steel.

c. Basic open hearth steel castings made in dry sand molds generally were quite free from pinholes. Basic electric steel castings, made under similar conditions, showed considerable tendency to form pinholes. Since the castings from the two types of steel were made in different foundries, it is impossible to give any idea of the relative tendencies of the two metals to form pinholes. It is possible that mold conditions largely determined whether or not pinholes were produced.

d. The analyses, in all cases considered, were similar. A typical analysis is as follows:

Element	Per Cent
Carbon	0.18
Manganese	0.70
Silicon	0.38
Molybdenum	1.10
Sulphur	0.015
Phosphorus	0.020

In order to minimize differences in microstructure resulting from differences in heat-treatment, all microstructures referred to herein were obtained by heat-treating two-inch samples from test bars in a small laboratory furnace whose control couple was adjacent the samples treated. The holding time was six hours in all cases. The samples were furnace cooled at a rate which was estimated to be equivalent to the air cooling of a large casting, or about 900 F (500 C) per hour through the critical.

Improvement in the Double Slag Process. It was first thought that the desired microstructures might be obtained from basic electric steel castings if the boiling period were lengthened so as to be more comparable to that of the basic open hearth. It was also thought that the reducing period should be as short as practicable to minimize pick-up of gases after the end of the boil.

Accordingly, the following requirements were placed on the steel making process.

a. The carbon in the charge should be 0.55 to 0.60 per cent.

b. The boiling period should be lengthened to approximately one hour, removing an estimated 0.40 per cent carbon.

c. The boil should be stopped when the carbon reaches a value equal to or only slightly below that desired in the finished product.

d. Forty-five minutes should be ample time for the reducing period.

Considerable improvement was noted in the basic electric product when the heats were boiled thoroughly and finished quickly. The microstructures showed decidedly better grain growth (Fig. 5) and it appeared that pinholing was lessened. However, it may be seen by comparing Fig. 5 with Fig. 2 that the performance of the open hearth was not equalled.

Single Slag Process. At this point it appeared that the possibilities for improvement of the double slag basic electric process had just about been exhausted without bringing the product to par with basic open hearth steel.

The following reasoning was then developed with respect to basic electric steel making.

a. The difference between basic electric and basic open hearth steel must be due to something beyond the elements normally measured by chemical analysis.

b. The difference could be caused at least in part, by neutral or reducing gases residual in the bath after an insufficient boil or reabsorbed after the end of the boil. Of these gases, nitrogen is most likely the trouble maker. It has been used on occasion to promote fine grained structures in steel. Furthermore, there is considerable likelihood of nitrogen absorption during the reducing period.

c. The apparently greater tendency of basic electric steel to pinholing could be due to greater quantities of hydrogen (and nitrogen) either residual in the bath after an insufficient boil or reabsorbed after the boil.

d. The boiling period should be of sufficient duration to eliminate residual neutral and reducing gases. Until it is possible to measure accurately gas concentration in molten metal this must of necessity be a cut-and-try procedure.

e. Since gas elimination ceases with the end of the boil and since re-absorption can begin immediately, the reducing period offers an opportunity for increasing the gas content of the metal.

f. The reducing period, save for the recovery of oxidizable alloys, performs no apparent useful function in the manufacture of steel.

g. If the reducing period were eliminated the resultant basic electric process can be quite similar to that of the basic open hearth.

h. Some cost reduction can be accomplished by the elimination of the reducing period.

As a result of the above reasoning the following basic electric steel making process was devised. This process should be classified as a single slag process in which the metal is tapped under an oxidizing slag.

a. The heat should be boiled thoroughly for good elimination of neutral and reducing gases. For the particular application in mind, a boil of about one hour's duration removing approximately 0.40 per cent carbon was thought necessary.

b. The carbon in the charge should be 0.55 to 0.60 per cent so that after the removal of 0.40 per cent, the concentration of that element should be approximately that desired in the finished product.

c. The boil should be blocked with 0.10 to 0.15 per cent silicon as soon as the carbon concentration reaches the desired value.

d. The manganese addition should be made immediately as low-carbon ferromanganese.

e. Since the end of the boil generally finds the bath somewhat colder than desired, approximately five minutes must be allowed for temperature adjustment. (Applying current after the end of the boil admittedly is against interest.)

f. The final silicon addition should be made to the ladle.

A number of molybdenum alloy steel heats produced in the basic electric furnace by the single slag process brought out the following complaints.

a. Since the usual fluidity measurements were not applicable, there was some confusion in judging temperature. It is believed that this complaint has been answered by the installation of an immersion thermocouple for accurate temperature measurement.

b. Erratic manganese recovery was experienced in heats whose boiling period was prolonged until the carbon value reached a low figure.

Fig. 5—Basic electric molybdenum alloy cast steel produced by double slag process—60-min. boiling period. Heat treated at 1922 F; 2 per cent nital etch. ×100.

Fig. 6—Basic electric molybdenum alloy cast steel produced by single slag process—60-min boiling period. Heat treated at 1742 F; 2 per cent nital etch. ×100.

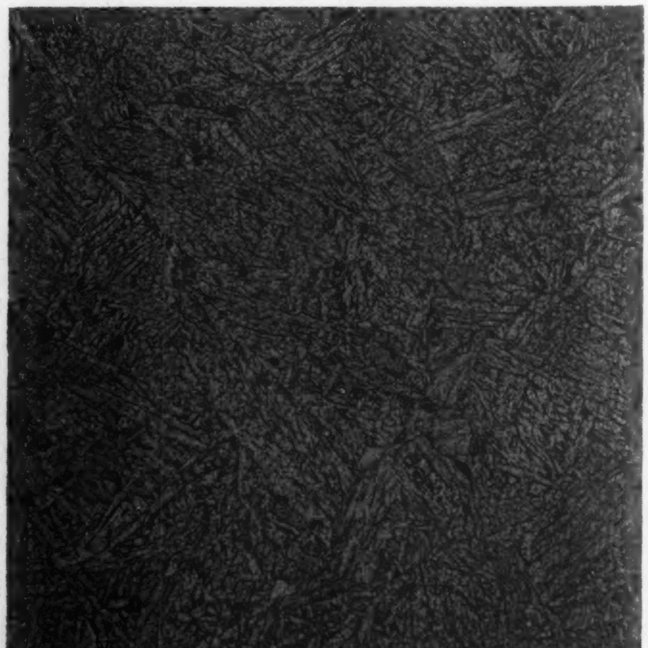


Fig. 7—Basic electric molybdenum alloy cast steel produced by single slag process—60-min boiling period. Heat treated at 1922 F; 2 per cent nital etch. ×100.

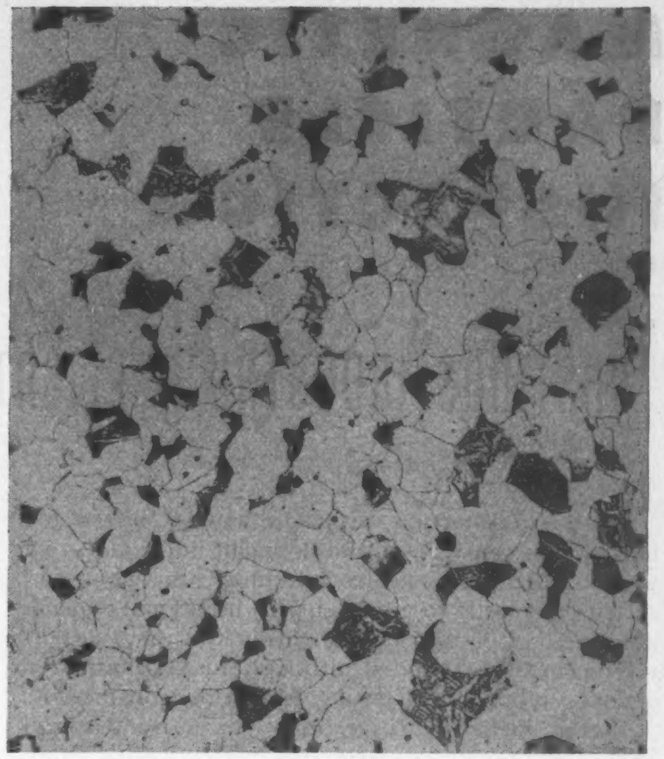


Fig. 8—Basic electric molybdenum alloy cast steel produced by single slag process—20-min boiling period. Heat treated at 1922 F; 2 per cent nital etch. ×100.

Figures 6 and 7 are photomicrographs of samples of steel produced by the single slag process in which a boiling period of one hour was used. Figure 8 is a photomicrograph of a sample from a heat which was boiled 15 to 20 min., but otherwise finished in the prescribed manner. It is evident that adequate boiling is necessary if full benefit is to be realized.

No data of value was obtained as to the relative tendency to form pinholes of the steel produced by the single slag process. Attempts to determine gas content, which should be a measure of the tendency of the metal to form pinholes, were not successful. The writers were further handicapped by the fact that there was no better definition of mold conditions than "dry sand" and "green sand."

Metal and Mold Standards

In the absence of the use of aluminum, probably both metal and mold should subscribe to certain standards, if pinholing is to be avoided. The opinion is ventured that the single slag process should produce steel of lower gas content than does the double slag process and hence the metal so produced should have less tendency to form pinholes.

A large number of medium to mild carbon steel heats also were produced by the single slag process. In these heats the boil was limited to about half the time duration and carbon drop used in molybdenum alloy steel heats. An aluminum addition of 2 lb per ton was made to the ladle about two minutes after pouring from the furnace was complete. Castings from these heats have caused no adverse comment and may therefore be considered satisfactory.

The saving in time and electricity realized by the elimination of the reducing period, obviously was the amount of each normally expended in the period.

The following conclusions appear to be justified.

a. The single slag process is capable of producing steel approaching the product of the open hearth in grain growth characteristics.

b. The reducing period in the basic electric furnace performs no useful function in steel making except possibly that of recovering oxidizable alloys from the slag.

c. Some reduction in the cost of a heat is accomplished by the elimination of the reducing period.

d. The single slag basic electric process is not a guarantee of freedom from pinholes if mold conditions are to be ignored. It is the opinion of the writers that this process produces metal of lower gas content than does the double slag process. How much lower is not known.

e. Measurement of gases in liquid metals is necessary if the tendency of the metal to form pinholes is to be evaluated.

f. This development is offered in its present stage of completion for the purpose of eliciting such criticism and suggestions as may be offered.

Acknowledgment

The authors wish to acknowledge the advice and assistance generously given by Messrs. F. W. Hanson and J. N. Ludwig, Jr., of the Electro Metallurgical Company and by Messrs. R. S. Archer and T. D. Parker of the Climax Molybdenum Company. Acknowledgment is also made of the cooperation of the superintendent and personnel of the General Electric foundry at Schenectady.

MAGNETIC PARTICLE INSPECTION

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CASTINGS INDUSTRY APPLICATIONS

THE MAGNETIC PARTICLE INSPECTION METHOD has had over fifteen years of development and use during which time it has passed from an interesting laboratory novelty to a well recognized, highly useful and dependable method of inspection. During the war years its use was greatly expanded, although this is equally true of every other useful testing and inspection method.

War vs. Peacetime Inspection. The entire matter of inspection of materials received a tremendous emphasis during the war years. Perhaps the largest factor bringing about this emphasis was the great expansion of the aircraft industry. This industry long ago had, of necessity, set standards of quality that made rigid inspection of all kinds a prime requisite in the production of all structures and parts. However, this emphasis was also applied to all items produced for the Army and Navy—to Navy hulls, propulsion machinery, and ordnance—to Army trucks, tanks, and ordnance.

High Quality Standards

In the application of mass production methods to the construction of all of this war equipment, many large and small plants became acquainted with the highest quality standards and the most searching inspection methods. Many of these plants were previously engaged in other fields in which precision gages, magnetic inspection, or X-ray had never been necessities. Consequently these plants and the executives and engineers who operated them became more inspection-conscious than they were before.

In our present-day economy, with a demand for products in general greater than most manufacturers can meet and materials difficult and sometimes impossible to obtain, the temptation is to use what comes to hand without looking too closely at quality. Inspection in many plants has, therefore, swung to the opposite end of the scale from where it was during the war.

There are signs that in the near future, however, marketing conditions will again change, and high quality, to win and hold customers in a competitive field, will return as an important requirement, and the problem of how far to carry inspection and what methods are justified will again come up for consideration.

The inspection department of a plant, unless headed by a man who fully comprehends the broader relationship of inspection to the whole business of producing goods, is quite likely to look with favor on new tools and processes which will build up the importance of the inspection function. But he may miss some of the implications of added inspection costs.

It seems obvious that the extent to which inspection of any kind may properly be applied in the production of any article or material is a matter of a proper point of view and a proper understanding of what inspection may be expected to accomplish.

All eyes are focused on this ultimate use to see whether the design, the materials, and the construction are satisfactory in the final analysis. How the product performs in service is the criterion of judgment of the effectiveness of design and construction.

Purpose and Scope of Inspection. Inspection, therefore, should insure that the product be as good as it need be to perform its function satisfactorily for a long period of time. In general, however, there is no particular need that the materials, parts, or product as a whole be held to standards of quality any higher than required for such a performance. It is necessary, therefore, to set up inspection procedures, as well as standards of acceptance and rejection for the inspector to follow, which are based on a thorough understanding of what may be and what cannot be tolerated in the part or finished product.

Whether or not a casting is defective and merits rejection is, therefore, not necessarily a question alone of the presence or absence of such things as cracks or shrinkage or other abnormal conditions. The question rather is whether conditions which are present will actually affect the usefulness of the particular part.

Defect Classification

We should rather consider that such conditions do not constitute defects in the particular part unless they do affect the usefulness of that part. They may be blemishes, departures from perfection, but they may not be defects. Failure to appreciate this distinction has often led, in the application of such searching inspection as the magnetic particle method provides, to the rejection of much material which was perfectly satisfactory for its intended use even though it contained conditions which for other purposes would constitute defects.

From this point of view then, any inspection process should be justified by the particular results which it can produce to the end that the product be as good as need be. The product need not necessarily be better but certainly may be no worse than required by its particular function and service. It is the responsibility of

the engineer or executive who decides on an inspection program to consider and judge his inspection procedures from some such point of view.

Most foundrymen can cite one or more instances in their experience with magnetic particle inspection during the war where such principles were violated. Most of these could be set down to lack of experience and lack of knowledge, both on the part of the writer of the specifications and of the inspector who applied them. Yet in the majority of cases it is difficult to blame these people because in the urgency of war production there was a lack of time in which to acquire this experience and knowledge.

The present period allows time to appraise all methods and procedures, and inspection methods which will survive such scrutiny must be economically justified in every application.

The magnetic particle method of inspection is no longer new or novel. It has been in use in hundreds of plants and in an extremely large variety of applications and the principles on which operation of the method depends are generally understood. However, the fundamentals of the method will be reviewed for the benefit of those not closely connected with its application so as to clarify the terms used and the procedures involved.

Magnetic Particle Inspection Methods

First, the method is a magnetic method and is, therefore, applicable only to the detection of flaws in materials which can be magnetized. This includes, of course, all iron and steel and many iron alloys, but does not include austenitic alloys of various compositions and naturally does not include non-ferrous materials such as aluminum, bronze, etc.

The method depends for its operation on the fact that if a crack or crack-like discontinuity in a piece of magnetized material is so located as to be transverse to the direction of the magnetic field in the material, that field is distorted and the flux lines are crowded or deflected around the ends of such a magnetic obstruction.

If the obstruction lies near enough to the surface of the material, Fig. 1, some of these flux lines will be crowded outside the material itself, and a leakage field is produced at the surface at a point over the discontinuity. The nearer the discontinuity is to the surface, Fig. 2, the stronger is this leakage field, and if the discontinuity actually breaks the surface as, for instance, a surface crack—the leakage field is quite strong and highly localized.

If a powder—either dry or suspended in a liquid—consisting of fine particles of magnetic material, be applied over such a surface in the vicinity of such a leakage field, some of the powder will be attracted and held by the leakage field and thus set up a magnetically-held pattern outlining the discontinuity.

The greater the obstruction in the magnetic path, the stronger the leakage fields. Sharp, deep cracks at right angles to the surface give the strongest patterns and large discontinuities below the surface, having a principal dimension at 90 degrees to the surface, are more favorable for the production of strong indications, Fig. 3. Small defects, or defects of unfavorable shape, must be close to the surface to be found at all.

Surface scratches or tool marks do not produce patterns except at very high levels of magnetization.

Two points are fundamental and at once apparent:

1. Given a part containing discontinuities, it is necessary, in order to produce good leakage fields, to so magnetize the part that the resulting field will intercept the discontinuities, and

2. The strength of the leakage field, and hence the strength of the powder pattern produced will vary with the intensity of the magnetization set up in the part.

Magnetizing methods, therefore, must be understood since use of the wrong method may make the inspection entirely unproductive, and it is also easy to see that any variation in technique that affects the strength of leakage fields produced will greatly affect the nature of the results obtained.

Methods of Magnetization

Magnetism of proper strength and direction for the part to be inspected can be induced in several ways. In the early days, portable electro-magnets were widely used as a source of magnetizing force. In the light of subsequent experience, this method has been shown to be least effective, though still used under certain circumstances.

Coils into which parts are placed, or coils wound with flexible cables to suit the size and shape of the part are extensively used in many applications, but the direction of such fields is not easily controlled in odd shaped parts. Also, there is an excessive amount of general leakage field because the magnetizing force is external and the flux path is completed through the air outside the material in which the defect is sought.

A much more effective method of magnetizing, when applicable, is to pass current directly through the entire part or structure or locally, as in fillets, by means of prod contacts applied to the surface, in a direction to set up fields favorable for the creation of maximum leakage fields at defects, Fig. 4. By this procedure the external flux lines are kept to a minimum, as the field

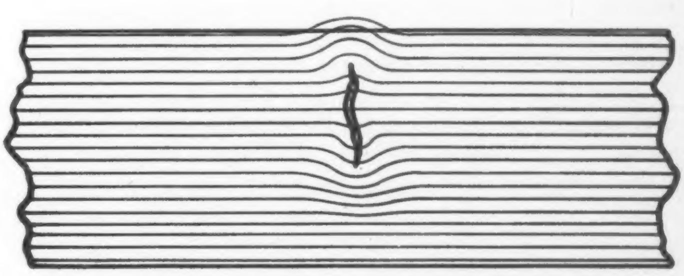

Fig. 1—Distortion of flux lines. Leakage field produced at surface at point over the subsurface discontinuity.

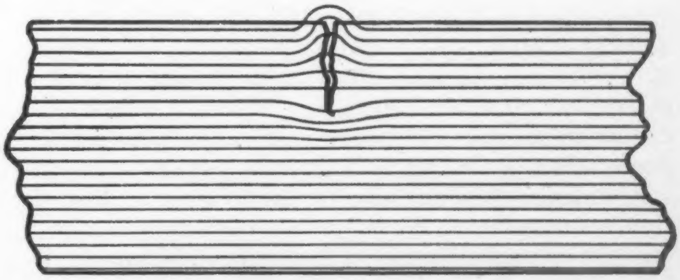

Fig. 2—Surface discontinuity causes distortion of the flux lines and produces highly localized leakage field.

Fig. 3 (right)—Magnetic particle (dry powder) indication of crack in casting. Fig. 4 (below)—Typical application of prod magnetization to casting.

set up by the current flowing through the metal is to a large extent contained within the metal itself. The term circular magnetization is frequently applied to this method, though in irregular shapes the path of the field is certainly not circular.

Since the direction of the field generated is always at 90 degrees to the direction of the current, it is quite possible in most cases to set up a field by this method in a desired direction by properly locating contacts.

The possibilities of varying the sensitivity of the method are numerous and complex. Obviously the stronger the magnetizing current, the stronger the field, and because of the magnetic behavior of materials, stronger fields always exist while the magnetizing current is flowing than after it is cut off. The residual field which a part retains is always only a fraction of that present while current is flowing. The residual field is also a function of the composition and hardness of the material, as well as of the amount of magnetizing current applied.

Continuous Method

For maximum sensitivity, therefore, it is evident that it is better to apply the magnetic powder simultaneously with the flow of the magnetizing current to take advantage of the stronger field then existing. This is the so-called continuous method.

Sensitivity may also be affected by the choice of magnetizing current—whether alternating or direct. Alternating current, because of skin effect, magnetizes the surface layers of material more strongly than those deeper in the part. Direct current on the other hand, penetrates more deeply into the cross-section.

For maximum sensitivity for the location of discontinuities lying below the surface, therefore, the continuous direct current method is the best. However, if interest lies only in surface cracks or discontinuities very close to the surface, alternating current is usually equally and sometimes more effective.

The term direct current is here applied to several types of single direction current. These are:

1. Non-fluctuating direct current.
2. Direct current with an initial surge of high current, quickly dropping down to a lower steady value.
3. Full wave rectified AC which is a slightly pulsating direct current.
4. Half wave rectified AC which is a form of intermittent direct current with no current flowing between the pulses of current which occur at the A.C. line frequency.

Direct current with surge generates an internal magnetic field in the work of a higher level than is produced if the metal is magnetized with the current rising to a steady level without the initial high surge.

The illustration shows by means of a magnetizing curve how this occurs, Fig. 5. The advantage lies not alone in the fact that the magnetic field inside the part is stronger, since this result could be accomplished by merely increasing the amount of steady current employed. The point is that the amount of external field due to the flow of current and consequently the amount of interference by this external field with the formation of powder patterns over defects, is less for the same magnetic level if the surge principle is employed.

A much more recent development extends the benefit of this principle to the inspection of all types of steel including soft materials on which the surge principle is not particularly effective. This development is the use of half-wave rectified single phase alternating current instead of direct current from any source.

Average Current

This half-wave current, Fig. 6, consists of separate pulses of direct current with intervals during which no current at all is flowing. Each pulse lasts for one-half cycle and the peak current reached is the same as the peak of the single-phase alternating current which is being rectified. The average current, however, which is read on the meter is only about a third of this peak.

Since power input and heating losses are more nearly a function of this average current, the system presents an advantage over direct current, alternating current, or full-wave-rectified alternating current in respect to size and cost of equipment necessary to produce comparable inspection results.

However, the magnetizing effect is determined by the peak value of the current and not by the average current or meter reading, and the result amounts to a high surge with each half-wave impulse. Thus with an average current of 400 amperes, there is a magnetizing effect equivalent to 1270 amperes. With this, results are comparable with, and in many applications considerably better as regards sensitivity, than those obtained with straight DC with surge, at 400 amperes steady current.

In addition, considerable advantage arises from the fact that the intermittent nature of the half-wave rectified current improves mobility of the particles and, therefore, sensitivity of the inspection. Because of the numerous advantages of this technique this method is finding a wide application not only for casting inspection, but for many other uses where maximum sensitivity is desired or specified.

There is, however, a definite trend away from the

doctrine, except where required, which insisted that the highest possible sensitivity should always be employed and that it was the business of the inspector to decide as to the significance of the conditions revealed.

Even in the casting field it has been found that the great sensitivity of the methods being discussed is not always an advantage. An excellent example is taken from the welding industry.

Many welds are designed with root openings or unfused root faces and the high sensitivity methods bring out indications of such root openings masking the presence of cracks lying near the surface. The illustration shows an instance of this sort.

A remedy for such confusing results was offered by James W. Owens,[1] who suggested that alternating current might be used to supplement direct current for the purpose of gaining additional information regarding the nature and depth of the condition producing such indications, Fig. 7. Equipment is now available to provide at the operator's option either AC or DC. Figure 8 illustration shows a portable unit from which both types of magnetizing current are available.

Another factor affecting sensitivity is the nature and shape of particles composing the magnetic powder or suspension. Experience has shown that the coarser elongated particles of the dry powders are much more effective in creating readable patterns indicating the presence of deep-seated defects than are the very fine particles generally used in suspension in a liquid for the wet method.

It would be possible to go further and discuss at great length the merits and limitations of various inspection techniques. However, in this paper, interest covers the entire subject of magnetic particle inspection and what its value may be in the foundry.

Another trend which is important to the future application of this method is in the direction of high speed inspections, and semi-automatic to automatic inspection equipment. Prior to the war, most installations of magnetic particle testing equipment consisted of a single unit which was expected to be as flexible as possible so that all sizes and shapes of parts might be inspected on a single machine.

Special Inspection Units

However, when large numbers of the same part are to be inspected, one machine may be kept busy continuously on this single job. A general purpose unit may not be well adapted to carry out such a particular inspection operation, and a special machine to do that particular job effectively would then be justified.

Magnetic particle inspection can, therefore, be put into the production line as a process complete in itself. This may involve such steps as cleaning before inspection, magnetizing, applying the magnetic particles, inspection, demagnetizing, and again cleaning before passing on to the next process, all on an automatic or semi-automatic basis. Such developments open fields of application for which the method had formerly been held useless because of lack of speed and consequent high cost.

There are other encouraging and healthy trends today in the handling of these inspection tools which are the result of greater experience and better understanding of the methods. There is a growing realization

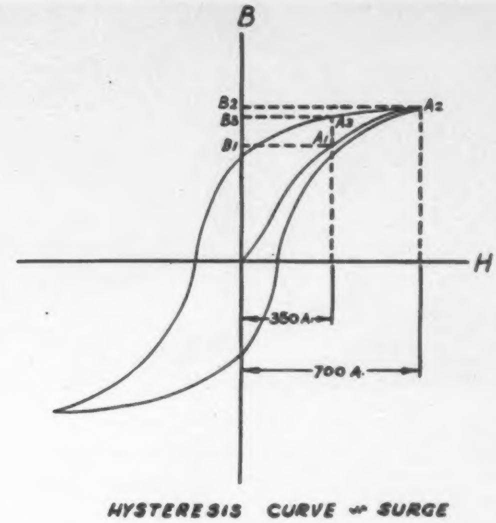

Fig. 5—Magnetization curve; initial surge advantage.

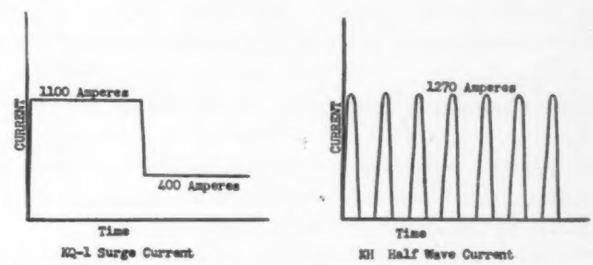

Fig. 6—Current output curves showing (left) direct current with surge, and (right) half-wave current.

that because of the wide variations in technique which are not only possible, but likely, to be used by various operators, results satisfactory from the point of view of each party interested in the inspection can be obtained only if the same techniques are used.

There has been great activity in the past two or three years in the direction of setting up specifications or recommended practices to guide the use of this inspection method. One such specification recently adopted as tentative by the ASTM relates to the use of the magnetic particle method in the inspection of castings. In addition to specifications such as these, many companies and government agencies have issued new or revised manuals setting forth the approved procedures for inspections involving their products or products in which they are interested.

Contract Specifications

The requirement for agreement between the customer and the supplier prior to a contract calling for magnetic particle inspection, which appears in the following excerpt from ASTM Specification A272-44T, is an excellent step:

"When in accordance with the requirements of the inquiry, contract, order, or specifications, castings are furnished subject to magnetic particle testing and inspection, the manufacturer and the purchaser shall be in agreement concerning the following:

1. A statement in the inquiry or specifications that the castings are to be subjected to magnetic testing.

2. The locations on the castings which are to be sub-

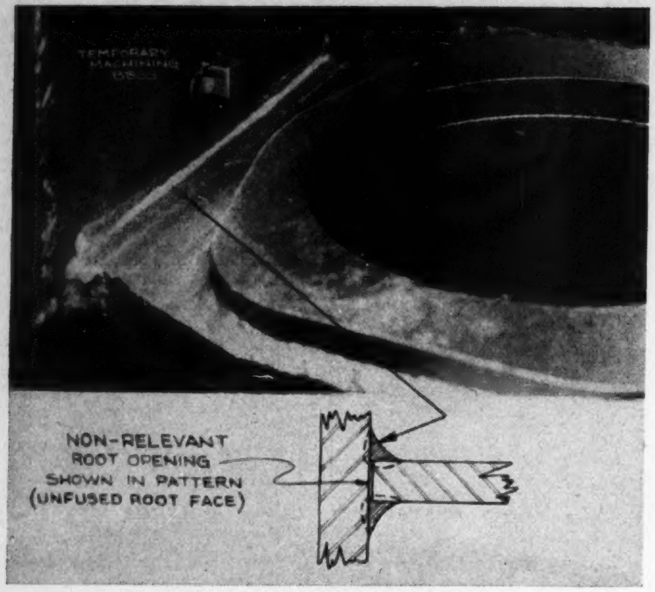

Fig. 7—Magnetic powder indication (DC) of non-relevant root opening. No pattern obtained with AC.

jected to magnetic particle testing shall be clearly defined or described.

3. The type, number, size, location, and orientation of cracks, hot tears, shrinkage cavities, or other defects that are to be considered injurious.

4. The stage of manufacture at which the test shall be conducted, surface preparation of the castings, the method of magnetization, magnetic flux density or magnetic force, field orientation, method of application of magnetic particles, demagnetization requirements, etc."

It is futile for the purchaser to specify magnetic particle inspection in a contract unless he defines how the inspection shall be made and what shall be considered the basis for acceptable or unacceptable material. Likewise, it is foolish for a foundry to accept such a contract unless these definitions are included. Merely to specify magnetic inspection for a part has no practical meaning, and would be the same as specifying a tensile test without setting the limits of strength required.

Yet specifications of this type—of which there are many—are of little use in any specific case. They do little more than discuss in general terms the various methods which may be used, the various types of current, equipment, and powders or pastes.

In the case of every individual foundry and every individual casting it is essential that the inspector or metallurgist, or whoever has supervision over the inspection, be capable of setting up the exact procedure to be used. If correlation with customer requirements is necessary, he must be capable of discussing the inspectin problem with the customer to arrive at a mutually acceptable method and standard of acceptance.

In the past, too much reliance has been placed on the ability and judgment of operators or inspectors who too often have been unequal to the task expected of them. General standards of acceptance and rejection applicable to large varieties of parts are impracticable.

Many plants, however, have found it of tremendous value to undertake and complete the often large task involved in setting up individual standards of procedure for magnetic particle inspection for each individual part as well as defining precisely what indications are acceptable and what are cause for rejection.

A final point of importance in the continuing development of magnetic particle inspection is the general recognition of the need for better interpretation and evaluation of the results obtained.

The concept that a defect is only a defect when it affects the usability of the particular part in which it occurs is one that has been slow in gaining general recognition. This is true as far as interpreting the results of magnetic particle inspection is concerned, and yet this concept seems so fundamental that it is difficult to understand why it was not recognized long ago.

With such an understanding of its proper application, the magnetic particle method can be expected to serve industry more effectively and maintain a permanent place as a method of test with a well established field of application.

In the foundry, magnetic particle inspection is used to examine castings for hot tears, shrinks, shrinkage porosity, thermal cracks, blowholes, cold shuts, and slag and sand inclusions. Unfused chaplets and chills also may be located.

The purposes and stages of production for which the method is used in the foundry may be broadly stated:

1. As an aid in developing molding and pouring technique.
2. As an aid in developing cleaning and foundry processing practices.
3. As an aid in production control.
4. As an aid in repair of defects.
5. As an aid in final inspection for defects.

These five foundry uses for magnetic particle inspection are discussed in the following:

1. As an aid in developing molding and pouring technique. The determination of the general quality of a casting of new design is rapidly made by magnetic particle inspection. Location and size of gates, risers, and chills, proper preparation of sand and cores, proper temperature of metal poured, all may affect casting quality and cause cracks, hot tears, shrinkage, etc. If detected in the first of a run of castings, these variables may be changed to eliminate defects before the pattern is put into production.

Co-operation Reduces Cost

In addition, important increase in yield is possible. In one foundry, sound castings being produced with a certain number and size of risers were poured with fewer and smaller risers until this method of inspection detected shrinkage. The risers were then increased in size slightly to give sufficient metal. The pounds poured compared with the weight of cleaned castings was decreased considerably, showing an important cost reduction through intelligent co-operation between the production superintendent and the chief inspector.

Thompson Vann and Dunlap McCauley[2] have stated that magnetic particle inspection is one of the more popular methods of inspection and perhaps the most effective in its application to a production line in a ferrous foundry. They say that their first use of magnetic particle inspection was to detect defects in cast steel tank bogie wheels. It was soon evident to them that casting procedures could be studied quickly and efficiently by this method, and adjustments made promptly.

Vann and McCauley state: "Magnetic particle inspection has proven a valuable tool in the authors' plant. All special products are either 100 per cent magnetically inspected or spot checked at frequent intervals. Magnetic particle, radiograph, macroetch, and pressure tests are all used in routine inspection . . .

"Cast steel tubing was produced and fabricated for stern tubes for cargo ships.

"Several defects due to incorrect casting procedure were found with the aid of magnetic inspection. Pouring temperatures and times were found to be of major importance in controlling the quality of these tubes.

"Magnetic inspection was used in the development of centrifugally cast fly wheels for tank motors. . . . In the casting, shrinkage running radially from the center towards the outside diameter was experienced. This was eliminated by changing the thickness to obtain directional solidification.

"Tiller brake quadrants for LSM craft, weighing about 900 pounds, are representative of static castings. Magnetic inspection was used in a study of the gates and risers and their effect on casting soundness."

2. As an aid in developing cleaning and foundry processing practices. In addition to molding and pouring a casting the foundry must shake out, clean, and frequently perform operations such as tumbling, sandblasting, grinding, chipping, annealing, welding, and other operations to condition properly the raw casting for acceptance and use by the customer.

Conditioning Operations Important

Many times a sound casting *as poured* is found defective at time of shipment due to improper performance for some of these conditioning operations.

Magnetic particle inspection is often used with much profit in preventing such losses.

As an example, inspection was made of some lots of several hundred castings passing through the operations of (1) gate and core removal, (2) sand blast, (3) grind rough edges, (4) anneal, (5) chip and polish. Twenty-seven per cent of the finished castings had been rejected by the customer because of cracks which were large and detrimental to the use of the casting.

These lots of castings were inspected after each individual operation. Cracks were found in a large percentage after the grinding operation, though these cracks were small—much smaller than those causing rejection by the customer. Due to rough handling and shipping these small cracks grew to appreciable size.

The important thing was that the source of that particular trouble was rapidly found. The grinding operation was corrected so as not to produce the small stress raisers and rejection dropped 95 per cent.

3. As an aid in production control. When production procedures have been proven practical it is still necessary to control that production to determine that those procedures are not changed to the detriment of the casting. Production men are interested in periodic inspection to insure that control.

This is not the place to go into detail on the statistical control methods but every foundryman should learn about them. They reduce drastically the amount of inspection required yet provide commercially accurate reliability for the entire production.

For example, it might be decided that five per cent defectives could be expected in a certain type of casting and the cost of such borne by the foundry. A proper number of random samples would be chosen from the production each day and inspected and a chart kept of the actual per cent defective. If the quality remained in control, that is, within the established limits, the control chart would show the uniformly high quality of the product. If it went out of control, 100 per cent inspection could be immediately started, the trouble found, and corrective measures taken.

Magnetic particle inspection is efficient for this use because of its flexibility and speed.

4. As an aid in the repair of defects. Magnetic particle inspection is valuable not only in the location of the defect but is at its best in controlling the repair procedure. The following routine is standard procedure in many foundries.

1. The defective area is chipped out with an air hammer or melted out by flame gouging.
2. The chipping is checked by the prod method to determine when the crack has been completely removed.
3. The repair is made by arc welding.
4. The weld is ground smooth.
5. The welded area is inspected with prods to check the soundness of the weld.

In Paul Ffield's[3] paper this subject is commented upon as follows:

"For sound repair welds it is necessary to remove all traces of cracks or other significant defects. Frequent magnetic powder check during excavation will insure this with a minimum loss of time and with the removal of a minimum amount of metal. Experience shows that it is more reliable than acid etching when excavating cracks, and, with an experienced operator, just as reliable when excavating shrinkage or sand."

5. As an aid in the final inspection for defects. It is not considered that it is within the scope of this paper to go into detail on this subject. Much work has been done and several excellent papers written on this gen-

Fig. 8—Portable magnetic particle testing unit providing AC and DC magnetization at operator's option.

eral application—its advantages, its limitations, the various methods, the necessity for experience and training of inspectors.

However, in the opinion of the author, two phases of the use of magnetic particle inspection which have previously been mentioned in the excellent papers quoted before bear repeating. Their importance for inclusion here is due to their effects upon the reduced cost of inspection as a whole.

The first is the use of production types of equipment mentioned earlier in this paper. In the inspection of small and medium sized castings produced in quantity, it is frequently true that the cost of handling the pieces, the magnetizing and applying of the particles takes appreciably more time than the inspection. Frequently these operations can be mechanized, and greater effort to do so will be well rewarded in lower costs.

Special Purpose Units

Several years ago a specially designed unit was made for the aircraft engine manufacturers for the purpose of inspecting cylinder barrels. Although most of them were made from forgings, the Ford Motor Co. was successful in making them from steel castings, and this type of unit was of considerable assistance in the determination of the proper amount of extra stock on the outside surface and the extra length necessary to pour a sound casting.

The unit has also been used for other cylindrical shaped castings in production. It magnetizes in both directions, and two men can completely inspect for defects in all directions at the average rate of around 100 pieces per hr.

Crankshafts which are frequently cast are large and heavy for manual handling and are made in quantities. A large magnetic particle inspection unit was built to perform all operations except the visual examination automatically. The shaft is placed on the conveyor chains and carried along by an intermittent hydraulic drive. Its first stop is under the hood on the left, where it is magnetized either in a coil or by passing current through the shaft, and at the same time the wet bath is applied to the casting.

Demagnetizing and Washing

The next stop is at the inspector's station where the shaft is examined. The carriers on the conveyor are rollers so that the inspector can rotate the shaft easily. The third stop carries the shaft into the hood at the right and it is there demagnetized by reducing and lowering the AC current flowing though the demagnetizing coil. The shaft then passes out of the demagnetizing coil through a spray to wash off the inspection bath and stops at the end of the unit for removal by overhead hoist.

The speed is adjustable, depending upon the inspection time necessary, but averages 60 per hr. for large truck engine shafts.

These two examples demonstrate the possibility of increasing the speed of inspection and greatly decreasing the amount of labor required. Also important is the fact that inspection keeps up with production enabling the production of defective parts to be stopped before a large backlog has been made.

The second point is that of the correlation of magnetic particle inspection with radiography so well expressed by Ffield as follows:

"A useful way of using magnetic powder inspection is to make it complement radiographic inspection. For example, if in the radiographic inspection of a series of identical castings it is found that some are defective in the same area, a standard often can be created for this location. Areas which have been radiographed are also inspected by magnetic powder.

"The powder pattern is compared with the radiographic image and the relationship between each method of test established as a standard for the area under consideration. Subsequent castings then may be magnetically inspected instead of radiographed in this area, at a considerable saving in time. An advantage of this form of inspection is that it enables the operator to gain experience in the evaluation of magnetic powder indications.

"The foregoing method is particularly useful when shrinkage must be located and evaluated. If shrinkage is present in a specified area, it usually will recur in exact locations and assume the same general contour in each succeeding casting, thus establishing the shape and location of the magnetic powder pattern.

"The method is useful, too, for other defects. For example, the design of a casting may be such that a certain area is prone to trap sand, the presence or freedom from which sometimes may be rapidly established by magnetic powder inpection after the reliability of the technique has been established for that area with the aid of radiography.

"In the case of castings which are being radiographically inspected, the foundry can save considerable time and unnecessary work if the surface defects are located by an 'all-over' magnetic powder inspection. The time consumed for such a test would be only a few minutes from start to finish, and the inspecting personnel is assured that most of the surface defects and many subsurface discontinuities have been located."

The proper use of the magnetic particle method along with other non-destructive test methods now used may well have an important effect on the design of metallic parts in machines in the future. Under the development of present day techniques the old factor of safety method of design is gradually giving way to more confident and effective utilization of a higher proportion of the strength of structural materials.

As is always the case, an improvement in tools is reflected in an improved product, but to derive full benefit from an improved tool requires skill and experience, which can only be obtained by a period of training and experiment. The past ten years has been such a period for the magnetic particle inspection method, and it is expected to be applied to future problems more intelligently than has often been the case in the past.

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GUN METAL CASTINGS

RADIOGRAPHIC TESTS

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IN RECENT YEARS much attention has been devoted to the radiography of steel and aluminum castings while little progress has been reported on the radiography of bronze castings. The radiographic standards for steel and aluminum castings have not only contributed to increased safety, higher quality and fewer rejects, but have also caused the respective foundries to learn more about the foundry practice by which high quality may be secured.

The radiography of bronze castings has been neglected, probably, because a large proportion of bronze castings require a pressure test. The pressure test, however, may be very deceiving as to the true quality of the metal. It yields no information concerning the metal below the thin skin of the casting which may be removed by abrasion, corrosion, machining or drilling.

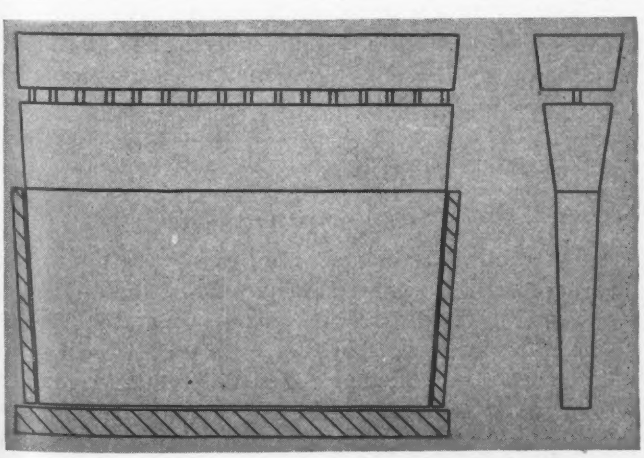
The pressure test is limited in pressure and time of application. There is no provision for sudden overloads caused by water-hammer or the slow, continued penetration of corroding solutions in service. It is not surprising that many castings which pass rigid inspection tests still fail by leakage after only two or three years in service.

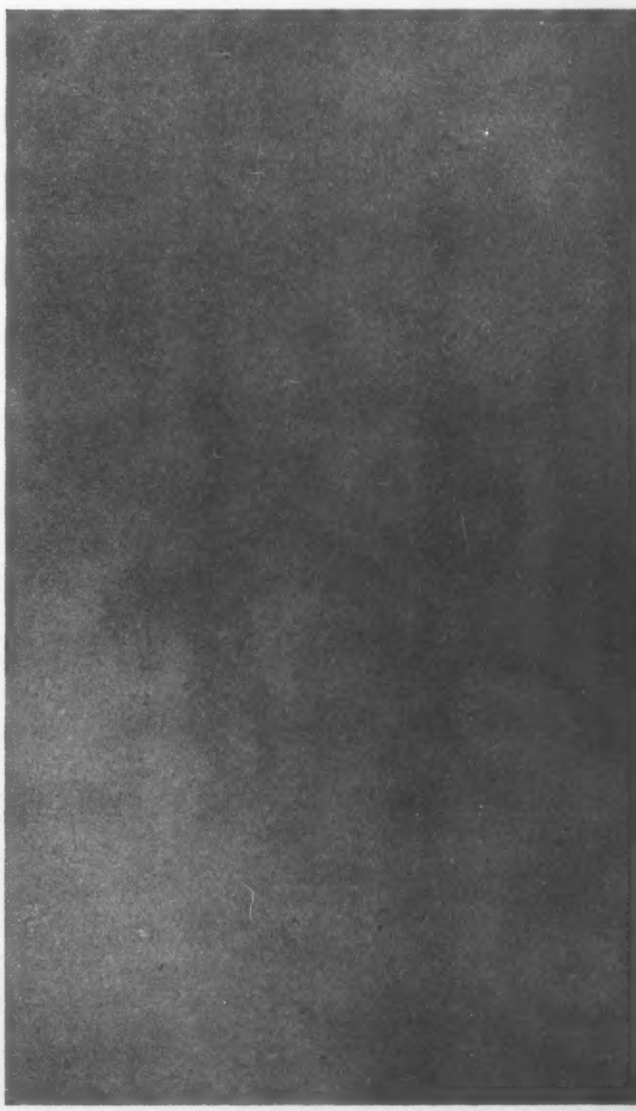
For these reasons there is a definite need to supplement the pressure test with a more discriminating method of testing. The fact that a casting leaks should be supplemented by knowledge of the cause of the leakage. Knowing this, the foundry engineer may make appropriate changes in melting, molding or casting practice in the particular foundry.

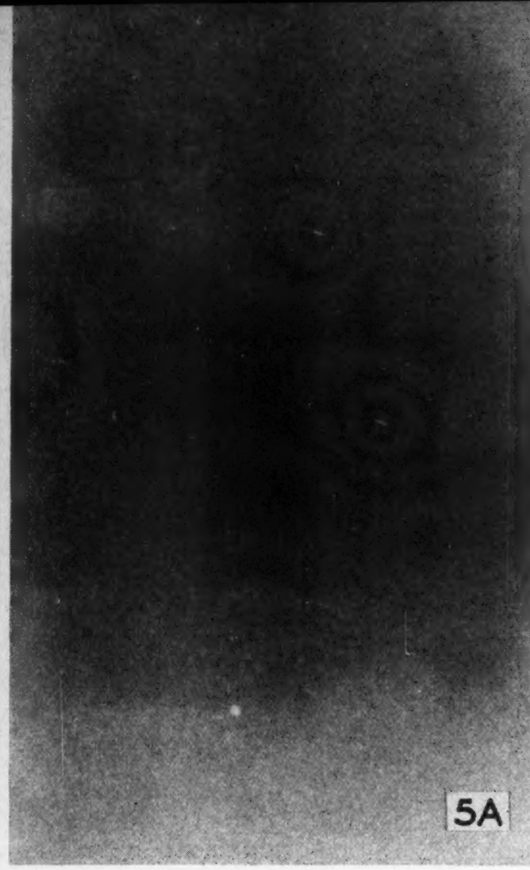
The Navy recognized the importance of radiography of steel castings in 1942 when the "Radiographic Standards for Steel Castings" were released by the Navy Department.[1] These standards have been of great wartime value to industry in general as well as to the companies working specifically on naval construction. Once the inspector has a clear mental picture of the standards, it is necessary only occasionally for him to refresh his memory.

Radiographic standards for aluminum casting were developed shortly after the steel standards. This work was done largely by the Army Air Corps.[2] These standards have proven beneficial to users as well as manufacturers of aluminum castings. The user is assured of

Fig. 1 (below)—Casting plan of plate. Fig. 2 (right)—Radiograph section (center portion) taken from radiograph of entire plate. Casting made as shown in Fig. 1.







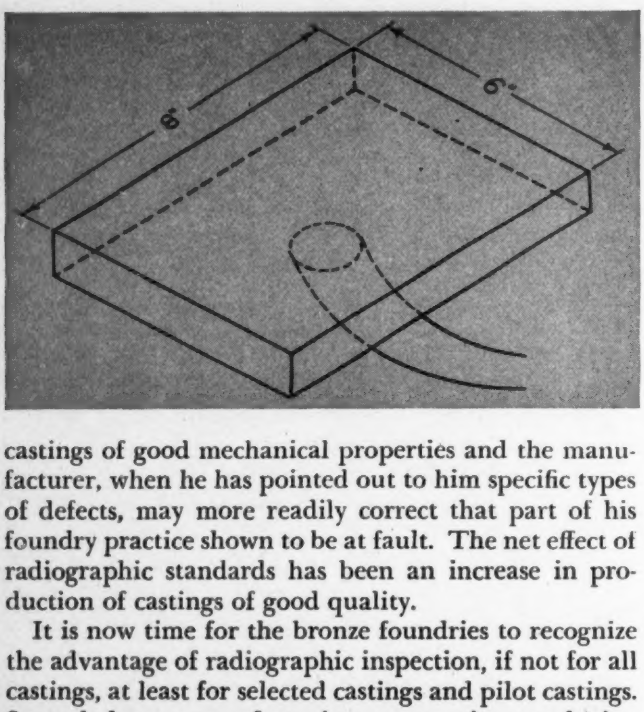


Fig. 3—Sketch showing dimensions of plate with reversed horn gate. Fig. 4—Spongy shrinkage; no riser. Unless otherwise stated, all plates cast horizontally. Fig. 5A—Spongy shrinkage. Riser 4 in. diameter and 2 in. high in center of plate. Fig. 5B—Spongy shrinkage. Riser 3 in. diameter and 4 in. high in center of plate.

castings of good mechanical properties and the manufacturer, when he has pointed out to him specific types of defects, may more readily correct that part of his foundry practice shown to be at fault. The net effect of radiographic standards has been an increase in production of castings of good quality.

It is now time for the bronze foundries to recognize the advantage of radiographic inspection, if not for all castings, at least for selected castings and pilot castings. Several large manufacturing companies producing bronze castings have set up company standards for their own use. In general these standards consist of typical radiographs of castings, more or less arbitrarily designated as to quality on the basis of the radiographs. The standards usually have three very broad classifications. These classifications are: satisfactory, borderline and unsatisfactory.

The various company standards suffer from the common fault of being based on such a variety of sizes and shapes of specific castings that the radiographic standards find limited use outside the particular fields of operation of the respective companies. At the present time variations exist in the definitions of the terms "satisfactory" and "unsatisfactory" in the various specifications of quality of bronze castings.

The purpose of the present work is to identify various typical defects in gun metal by means of radiographs. More than one hundred gun metal plates 8 x 6 x 1 in. of nominal composition 88 per cent copper, 8 per cent tin and 4 per cent zinc were cast under carefully controlled conditions so as to produce the defects. Complete records of the melting and molding practice were kept to facilitate the reproduction of the defects when required. The defects included distributed shrinkage, hot tears, sand and slag inclusions and gas porosity.

No attempt was made in the present investigation to evaluate the seriousness of the defects or to place them in a scale of merit. The investigation was confined to the correlation of defects with foundry practice leaving for future work pressure testing of plates, micro-radiographs, fracturing and other destructive tests.

Experimental Procedure

The bronze was melted either in a lift coil induction furnace or in a gas fired furnace. The materials used consisted of Grade A copper, Straits tin and Horsehead zinc. Clay-graphite crucibles were used for all heats. The copper was melted down under a light charcoal cover and when molten, the tin was added followed by the zinc. When the temperature of the melt was 1150 C

(2100 F), two ounces of phosphor-copper per 100 lb were added. The crucible was then removed from the furnace, the charcoal skimmed from the melt and the castings poured at 1150 C (2100 F).

The sand used for making most of the molds was No. 00 Albany, faced with a dry graphite wash. Some of the molds, especially those made to produce tears, were made with a synthetic sand because of its greater strength.

The radiographs were taken with 220 kv and ten milliamperes with an exposure time of five minutes and a 36 in. target-to-film distance. A lead filter 0.03 in. in thickness was used at the source and lead intensifying screens 0.005 in. in thickness were placed on both sides of the film. Eastman type F x-ray film was selected on account of its widespread use and fine grain size. The density of the radiograph was kept as close to 1.25 as possible; a stepped penetrameter of gun metal of 2, 4 and 6 per cent sensitivity was used.

Radiographically Sound Bronze—Preliminary Investigation—Although flat plates of gun metal may be difficult to feed, there are several methods by which plates of good quality may be cast either horizontally or vertically. If good directional solidification is provided by the use of chills, padding or insulation, good results will be obtained. A method of casting a plate in a vertical position in the mold is shown in Fig. 1. The size of the pencil gates is such that little splashing and a minimum of turbulence takes place. At the same time the pencil gates are of sufficient size that feeding is permitted at the proper time.

The chills along the edges of a plate of this size are essential in promoting directional solidification. Although the dimensions of this plate (8 x 14 x 1 in.) are considerably larger than the dimensions of the plate (8 x 6 x 1 in.) used in the major portion of the investigation, it is seen in Fig. 2 that larger size has not proved detrimental to the production of a sound casting because the principles of good directional solidification could be followed.

Defects in Bronze Castings. In common with other alloys having wide solidification ranges, tin bronze is subject to spongy shrinkage when it is not adequately fed. In order to produce conditions favorable for this defect a bronze plate was cast as shown in Fig. 3 with the reversed horn gate entering at the center of the plate. The severity of the defect was controlled by placing risers of various sizes just above the gate.

Riser Factor in Shrinkage

Figures 4 and 5a show that the riser often may be an important factor in determining the extent of the shrinkage. In fact, with no riser whatever this plate has a uniformly distributed shrinkage. As shown in Fig. 5b, the riser may cause the shrinkage to become more concentrated.

The weak skin strength of the bronze gave some difficulty in artificially producing the concentrated type of spongy shrinkage. In castings made in a horizontal position in the mold, the surface of the casting had a tendency to be caved in by atmospheric pressure over the positions in the plate where the shrinkage was intended to occur.

This difficulty was not so serious when the plate was cast vertically as shown in Fig. 6. With no risers and chills one-eighth inch in thickness placed along the edges, the plate was made to solidify without the benefit of proper directional solidification. The skin of the casting did not cave inward under atmospheric pressure in spite of the concentrated type of spongy shrinkage at the center of the plate, Fig. 7, the last portion of the casting to solidify. The chills had a strong influence in causing the shrinkage to be concentrated.

The casting, made exactly the same as in Fig. 6 except for the omission of the chills, had "lacy" and interconnecting shrinkage which appeared to follow the

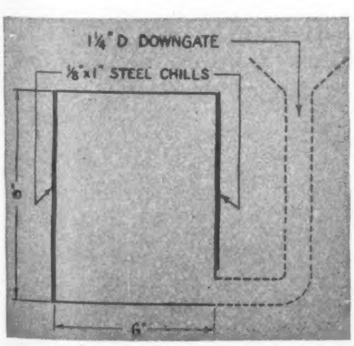


Fig. 6—Sketch showing dimensions and location of chills in the vertically-cast test plate.

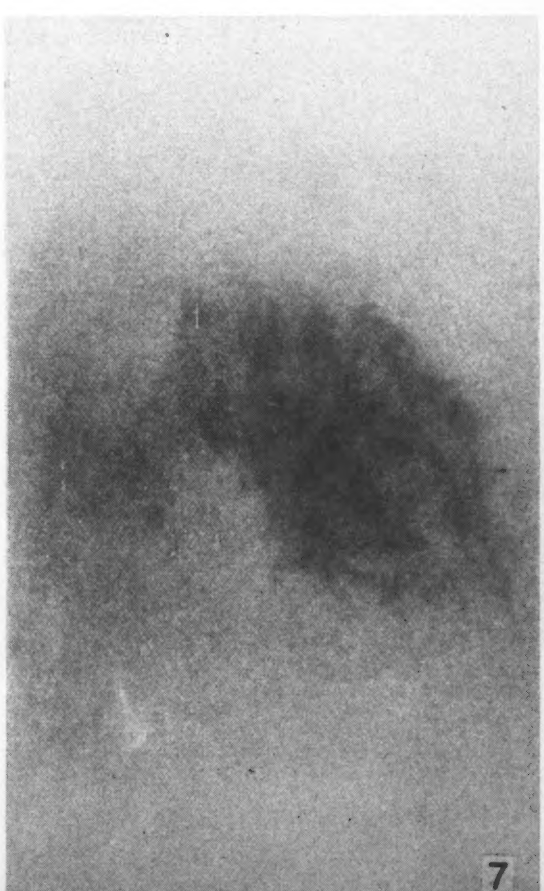


Fig. 7—Radiograph showing spongy shrinkage concentrated in center of plate, due to chills.

Fig. 8—Interconnecting "lacy" shrinkage; the plate was cast vertically; no riser employed.

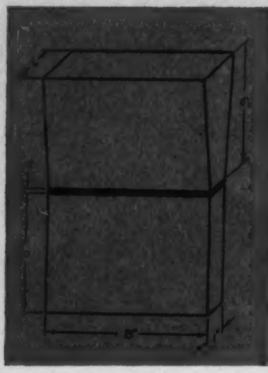


Fig. 9—Sketch showing plate dimensions, riser and core sand strainer.

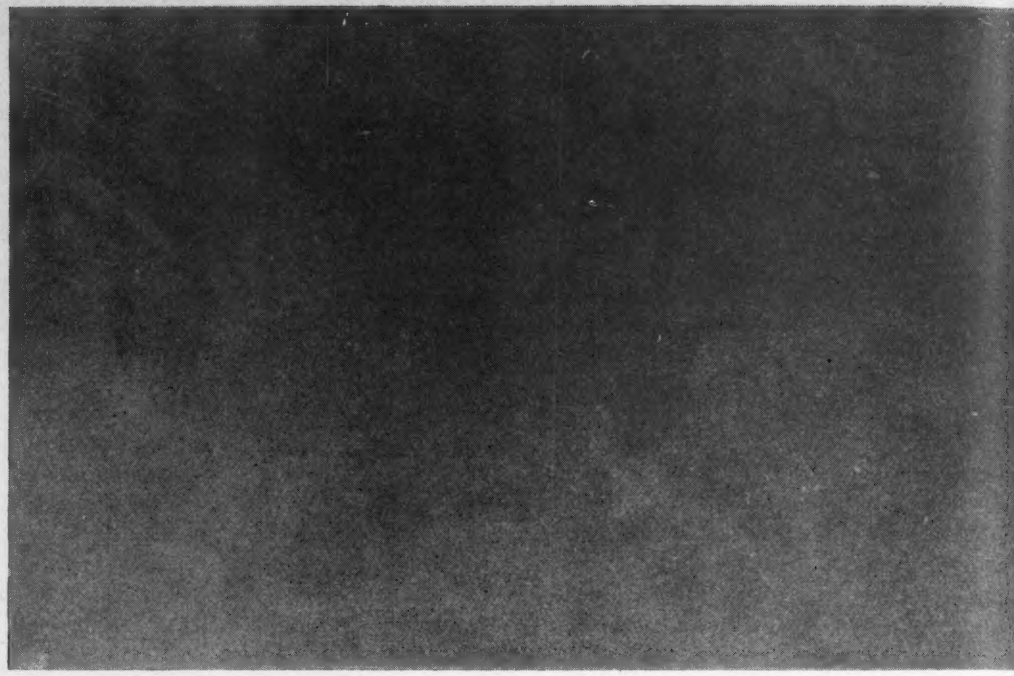


Fig. 10—Radiograph showing piping shrink; vertically-cast plate.

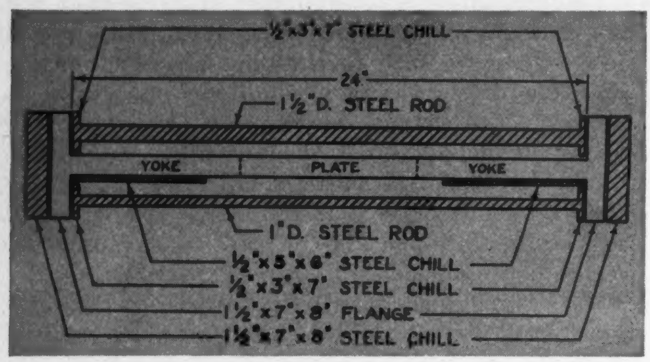


Fig. 11—Cross-sectional sketch of the hot-tear test casting showing chills, steel rods and dimensions.

Fig. 12—Photograph showing the hot-tear test casting with the risers and steel reinforcing rods in position.

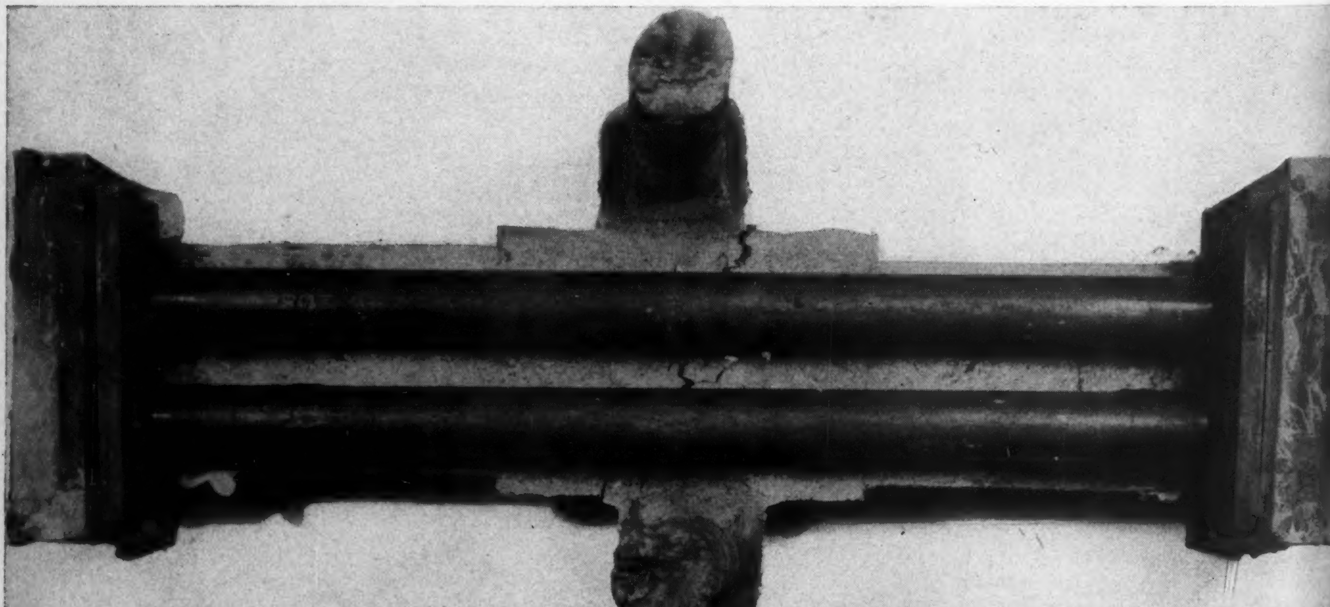
outline of the grain boundaries as shown in Fig. 8. This is one of the worst types of shrinkage from the standpoint of pressure tightness.

A special form of concentrated shrinkage, often associated with ingates of improper dimensions, is called "piping" shrinkage. As shown in Fig. 10, the channels between the dendrites of the casting have a characteristic tuberous appearance.

Bronze Gates

This failure is by no means restricted to the pencil gates which were selected to illustrate this type of failure. Whenever bronze is gated directly into the casting, such as in Fig. 9, rather than into the riser, there is danger from "piping" shrinkage.

The form taken by various defects is greatly influenced, not only by the positions of the gates and risers, but by the contraction of the solidified cast-



ing and the resistance offered by the mold to this contraction. When the mold hot strength is too high, the casting will be pulled apart by its own internal stresses during solidification.

A mold reinforced with steel rods was made as shown in Fig. 11 in order to produce hot tears in the gun metal plates. The crack was made to occur in the center of the plate by keeping this portion of the casting at elevated temperature (in the hot short range) while the remainder of the casting was rapidly cooling to a lower temperature. The gates at the center of the casting also served as risers, thus promoting the desired gradient of temperature.

Distance Between Flanges

The severity of the hot tear was strongly influenced by the length of the yokes between the flanges. Considerable difficulty was encountered in preventing distributed shrinkage occurring adjacent to the hot tear. The hot tears shown in Figs. 12, 13 and 14 are transverse to the direction of applied stress.

Most of the preceding heats were melted under identical conditions. The defects, therefore, may be related directly to gating, risering and molding practice. Quite a different situation exists when the metal is supersaturated with gases which have been dissolved during the melting process. The radiograph in Fig. 15 presents the mottled appearance which is characteristic of bronzes which have distributed gas porosity. This particular metal was produced in a gas fired furnace with a reducing atmosphere (no cover or flux) and was not deoxidized with phosphor copper before the pouring of the casting.

To produce gas porosity artificially, it is necessary to add a suitable combination of reactive compounds to the metal or mold. Such compounds include the following: copper oxide, hydrides of low temperature of decomposition, hydrocarbons such as linseed oil and excessive moisture. The finely distributed gas porosity shown in Fig. 16 was caused by five grams of calcium hydride sprinkled on the bottom of the mold. Best results were obtained when a steel plate $\frac{1}{16}$x6x8 in. was placed on the bottom of the mold to prevent the hydrogen from escaping.

Quite different from the various types of shrinkage and gas porosity which are somewhat dependent on the characteristics of the metal, are the inclusions produced by sand being washed from the mold. These inclusions present a similar appearance in all metals, being of identical material and of common origin. Figure 17 is an example of sand inclusions. A closely associated type of inclusion is seen in Fig. 18 which illustrates dross inclusions. In both instances about equal quantities of sand or dross were admitted to the mold by addition of the materials to the stream of molten metal. Castings with inadequate gating systems and few risers are likely to have these sand and dross inclusion defects.

Shrinkage Factors

The results of the shrinkage study show that the extent and type of the shrinkage depends on the gating, risering and chilling of the casting. Optimum height and diameter of risers are necessary for sound plates. Concentrated shrinkage in bronze is produced when the risers are too small in diameter and too high which causes them to freeze first and withdraw metal from the casting. Concentrated shrinkage also occurs when chills are placed along the narrow edges of the plate. Without either chills or risers the shrinkage tends to be dispersed.

Fig. 13—Dispersed spongy shrinkage with severe hot tear. Fig. 14—Hot tear with shrinkage at a minimum. Fig. 15—Gas porosity combined with spongy shrinkage.

16

17

Fig. 16—Gas porosity with some shrinkage. Fig. 17—Sand inclusions shown in this radiograph. Fig. 18—Dross inclusions in vertically-cast plate; no riser used.

It is believed that the control of the shrinkage is also closely related to melting practice. Optimum dimensions of risers, even for the same plate could conceivably be much different if the plate were melted or poured with other procedures.

Hot tears occur less frequently in bronze castings of small size and considerable difficulty was encountered before the plate finally was torn apart. An idea of the stresses in the casting may be gained from the fact that the steel bars shown in Fig. 11 were frequently bent with deflections of $\frac{1}{4}$ in. at the center, especially when the casting did not tear. This makes it easy to understand why the collapsibility of cores is so important in the production of sound castings.

Gas porosity was produced (1) by poor melting practice, (2) by additions to the melt which produce the same dissolved gases as bad melting practice and (3) by additions of materials to the mold cavity which give off the same gases as many molding materials. The gas porosity was shown to increase when a $\frac{1}{16}$ in. thick steel plate was placed on the bottom of the mold cavity. Low permeability of sand evidently increases the danger from gassy metal.

It is very evident that these experiments, while serving the purpose of producing radiographs, also point out many reasons why the effects of gas contamination may be so difficult to correct in the foundry: the melting, molding or the use of mold washes under some conditions may be the responsible factor.

Summary and Conclusions

Defects in bronze castings may be reproduced artificially in controlled amounts provided the foundry practice is carefully and thoroughly controlled.

The defects observed in radiographs of bronze castings are directly related to the foundry practice. This has been shown by correlations of the observed defects with melting and molding practice on more than 100 bronze plates. Only a few of the common, representative defects have been included in this discussion. Included among these common defects are distributed shrinkage, hot tears, sand and slag inclusions and gas porosity. Complete records of melting and molding practice were kept to facilitate correlation of defects with foundry practice.

Characteristic differences have been observed between gas porosity and distributed shrinkage. The gas porosity as exemplified by Fig. 15 tends to be evenly distributed and causes a hazy, indefinite appearance as if the film had been partially fogged before it had been used. This is considerably different from distributed shrinkage which, although spread over the central region of the plate, still has limits beyond which it does not occur to any great extent.

Defects such as gas porosity, shrinkage, blowholes, tears and dross often are difficult to recognize because they may not occur alone or in great quantity.

Acknowledgments

The author would like to acknowledge the assistance of Dr. B. M. Loring and Mr. Herman Kaiser in giving much helpful advice. The radiographic work done by Mr. Stevens is also greatly appreciated.

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FOUNDRY SAND LABORATORY

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DURING THE LAST DECADE the foundry industry has become more and more laboratory conscious. Because of this, smaller foundries are contemplating the installation of foundry sand laboratories for control and research purposes. It is the intent of this paper to outline briefly the organization of such a laboratory.

Strictly speaking, the foundry sand laboratory does not include the chemical laboratory, metallurgical laboratory or x-ray laboratory. These departments, which deal directly with semi-finished manufactured goods may be considered as "engineering inspection stations" for the foundry products.

For example, the chemical laboratory performs routine analysis on drillings or other types of samples secured from incoming ingot, remelted metal, and the outgoing casting; the metallurgical laboratory analyzes and controls grain size, alloying elements, type of heat treatment and other physical aspects of the final foundry castings; the x-ray laboratory devotes its time to the inspection of outgoing castings and the development of gating and risering techniques.

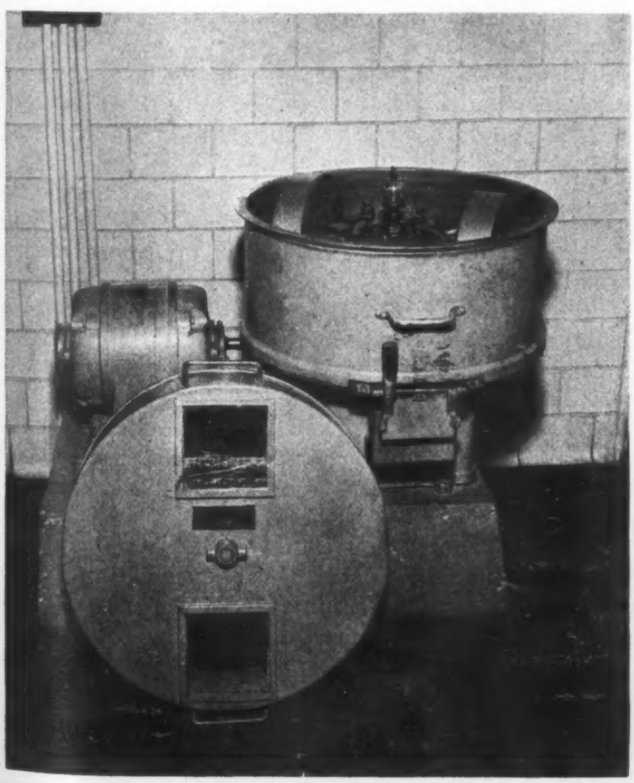
The foundry sand laboratory, on the other hand, usually works with expendable materials that are used during fabrication of the semifinished product. This laboratory controls and experiments with the sands, binders, mixtures and their treatments; the best method of baking, ramming and treating the cores for the castings; the use and application of different types of washes; the venting of the molds and other functions.

The foundry sand laboratory usually does not deal directly with the finished product. It only controls the modes and practices of manufacturing the product.

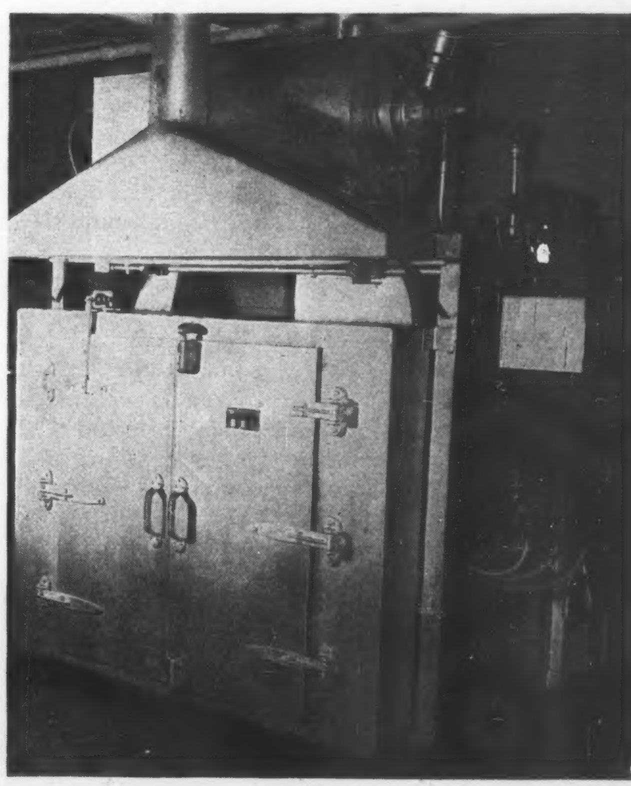
Why is a foundry sand laboratory necessary if its functions are only indirectly connected with the final casting? There are perhaps eleven significant points which must be considered:

1. *To control the uniformity of the product.* The reputation of any organization is based not only upon what it produces but also how uniform is its product. Uniformity together with inherently high quality can be obtained only through vigilant control. A few non-uniform castings in the hands of such meticulous con-

Laboratory mixer used for experimental mixtures, a replica of the 3000-lb mixers employed in foundries.



A gas-fired oven, equipped with automatic temperature recording apparatus, used to bake experimental cores.



Apparatus used in determination of moisture contents of sand mixtures by calcium-carbide "bomb" method.

Percentages of sand remaining on the mesh screens are determined by mechanical shaking in this machine.

sumers as the automotive or aircraft industries may easily spell doom for the small foundry.

2. *Control of manufacturing process.* In addition to controlling raw materials to achieve uniformity of a product it is necessary to control the method by which the product is made. Has there ever been a foundry in which scrap castings continue to recur despite the fact that "we have not changed a single thing?" This familiar phrase probably will continue to be quoted ad infinitum, but a foundry sand laboratory will aid in alleviating this condition.

3. *To improve products and practices.* Improvement means not only higher quality but a better method of producing the final product. The foundry sand laboratory has access to the newest methods of manufacture (through current technical literature) and should have the time to experiment with them.

4. *To control the expendable molding materials.* Although the chemical and metallurgical laboratories control the incoming materials which finally find their way into the finished casting (i.e., the metal itself), the foundry sand laboratory accepts or rejects such materials as sand, core oil, cereal binder, bentonite and other clays, pastes, silica flour, core washes, graphite, talc, plumbago, inhibitors, caulking compounds, partings, ladle washes, seacoal, blacking, etc.

All of these ingredients are used in manufacturing castings, yet not one of them leaves the foundry. Chemical analyses may be performed on these materials by the chemical laboratory but the foundry sand laboratory generally performs experimental and production tests with them.

5. *To investigate new materials.* The foundry sand laboratory, having access to the latest engineering data and technical publications, is in an excellent position to investigate new types of foundry materials. Samples of new materials should be forwarded to the sand laboratory for their examination before such products are placed in production.

6. *To aid management in solving certain production problems.* The foundry sand laboratory should be so well acquainted with its work that such typical problems as the following can readily be answered: Can the core baking cycle be speeded up in order to increase production without deleterious effect? Has the recent epidemic of hot cracks been caused by a non-collapsible sand mixture? Was the last shipment of silica flour of uniform quality?

What core sand mixture shall we use on the new lot of complicated castings just ordered? Shall we adjust the moisture content of our molding sand now that we are in a humid season? All of these questions and many others should be discussed with the foundry sand laboratory with the view in mind of aiding management in solving their problems.

7. *To perform engineering calculations relating to foundry practices.* The personnel of the foundry sand laboratory should be well acquainted with simple calculations so that the core room foreman having, for instance, "only 932 lb. of bank sand left" will be able to go to the laboratory and find out the exact mixture. This saves him the trouble of converting 10 pt. of oil per 1000 lb. of sand to X pints per 932 lb. of sand. Such terms as "Baume degrees" with reference to core washes, saponification number of core oils, special inhibitors such as ammonium-acid-fluoride, and other scientific terms will be readily explained in a laboratory.

8. *To maintain records of past performances.* Most

foundrymen believe that troubles occur cyclically and for this reason, if for no other, the records of past performances are extremely important. The sand mixtures "used last June when we were not getting cracks in our castings" can be important data next June when the castings crack at knockout. What kind of binder were we using two years ago when we could not get enough cereal? Have we raised the temperature of the core baking ovens within the last year? When did we lower the moisture content of the molding sand? All of these records may prove useful sometime and save the foundry thousands of dollars.

9. *To correlate data.* The wealth of figures conveniently inserted on data sheets are meaningless to foundry production unless these data are properly interpreted and correlated. The foundry practice unit will be able to aid production in correlating these data, in improving practices and writing procedures. Since most of the results obtained by foundry testing instruments are particularly valuable for comparison purposes, interpretation and correlation of these results is most important. A sand with a permeability number of 40 may be ideal in one foundry and useless in the next. The foundry laboratory will aid in the interpretation and proper use of such information.

10. *To perform routine analysis.* This is one of the main functions of the sand laboratory. Many a laboratory is merely a routine data assembly line where figures are accumulated and placed on sheets of paper and filed. All results must be analyzed to advise management exactly of conditions in the foundry at all times.

11. *To aid organization prestige and provide psychological control.* A foundry sand laboratory inherently increases the prestige of an organization in the eyes of management, the workers and competitors. The mere presence of a laboratory in a foundry will keep the workers alert.

These eleven reasons should provide present foundry management and potential foundry organizers with ample justification for the installation of a laboratory. They briefly outline the functions of a sand laboratory and how it may be used to aid in supervising foundry operations.

Every foundry can benefit from a laboratory. However, there are five specific instances when a laboratory is especially necessary or advisable.

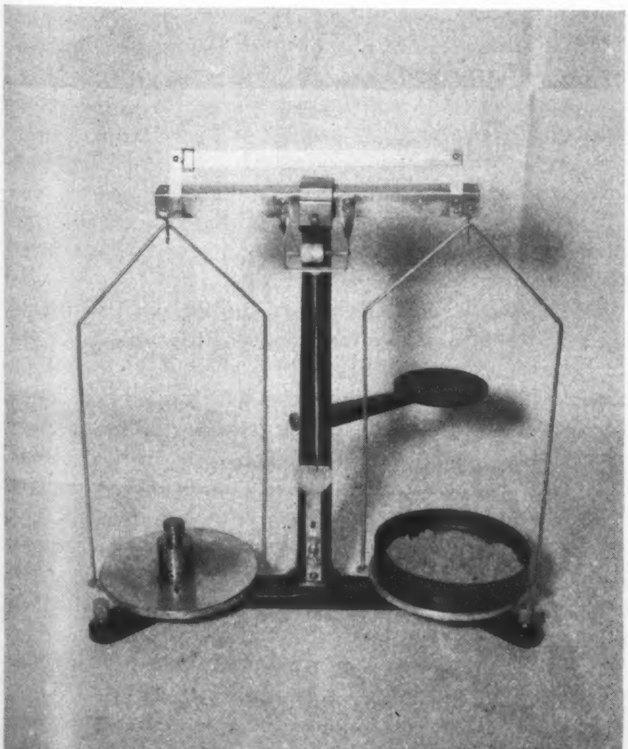
1. *Management is cognizant of poor control with attendant scrap castings and loss of money.* If management realizes the importance of a laboratory, and is fully cognizant of the monetary gain afforded by routine control, a laboratory should be started at once.

2. *Competition is too keen.* The foundry without a laboratory is at a great disadvantage in utilizing new products as soon as they become available. Even though induced to try a new product, an unbiased opinion can be gained only from within the organization and the sand laboratory is the place to get it.

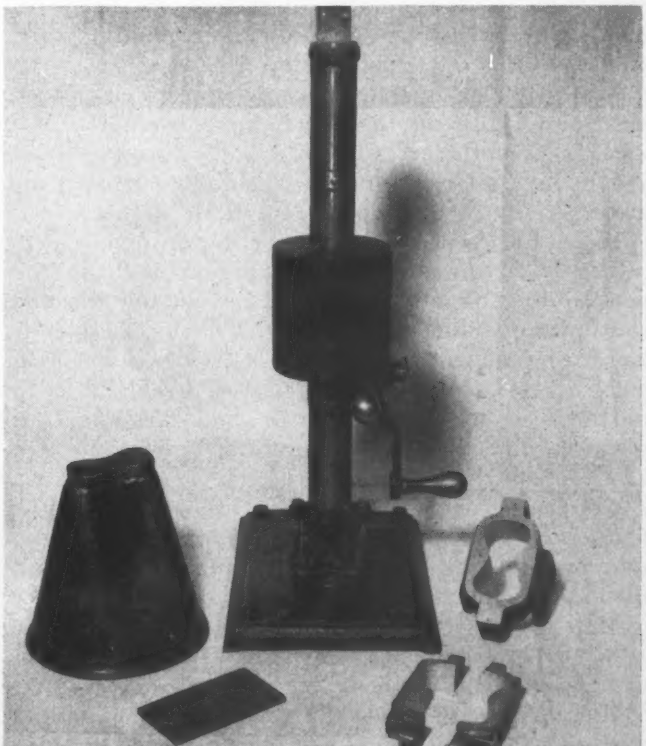
3. *A new financial appropriation with attendant expansion is near at hand.* Although the latest in mechanization is always foremost in the manufacturer's mind, a new plant should incorporate the latest design for a foundry sand laboratory as well.

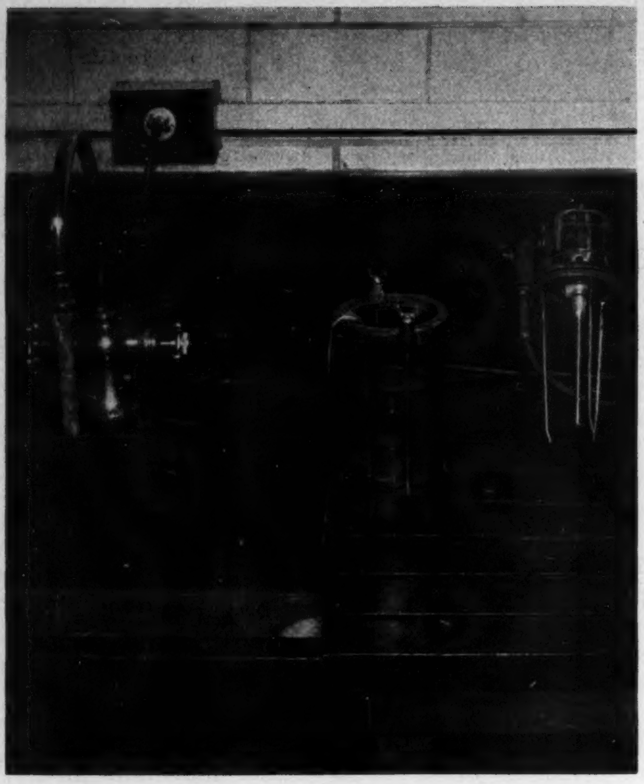
4. *Influx of new business.* The sudden influx of new business necessitating radical changes in foundry practices should call for the installation of a foundry sand laboratory. If the laboratory technician is able to work with the production management in setting up and designing methods for making the new products, he

Balance used to weigh sand for Dietert moisture test. Pan on the right has 100 holes per sq. in. on bottom.

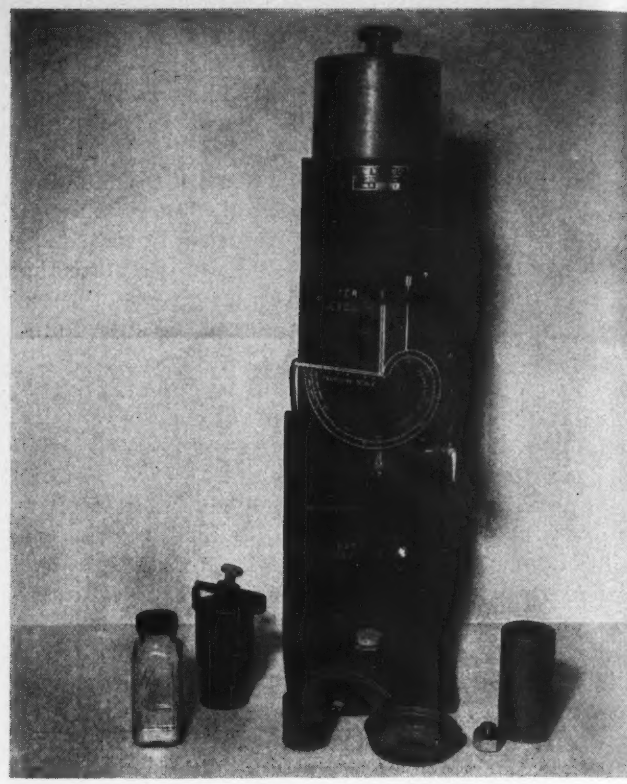


Tensile specimen rammer used to form briquettes in conducting the tensile strength tests on sand mixtures.





Clay analysis tester used in determining if percentages of clay in raw, crude sands meet plant specifications.



The permeability meter is a device used for measuring the amount of "pore space" between the sand grains.

will be in a much better position to aid management in solving future production problems.

5. *Management does not have time to experiment.* Because of other duties and pressure to get castings to the consumer, much recent technical information is unused. Management should realize this and take immediate steps to use the information by installing a foundry sand laboratory. This unit must have time outside of its routine duties to perform the necessary assimilation, interpretation and experimentation with all of the latest applicable technical data.

The question may arise as to how to start a laboratory in a foundry. In the first place, the originator of the idea must feel the necessity for it himself sincerely and should not just be trying to get another department under his control (with attendant extra prestige).

If the reasons for a laboratory given in the first part of this paper do not essentially fit into his case, the whole subject should be dropped and the foundry will continue to produce castings in the same manner it has during the past years. However, should more efficiency be the goal of the executives, it should be a fairly easy matter to explain to them how they can make still more money through the installation of a foundry sand laboratory.

Use can be made of the points brought out in the first part of this paper, with the explanation, of course, that less scrap will be produced, that new methods and materials will be discovered to make a higher quality casting and that the laboratory will make a valuable addition to the company as a whole. The mere mention of these points may not be enough and the organizer of the laboratory may need to keep insisting, reminding and selling his objectives before anything will be done.

For a man to run the laboratory, look first within your own organization. Although the laboratory may be non-productive in the accounting sense of the word, it will pay management back many times if it is correctly organized and operated.

Preferably, the supervisor of the laboratory should be a graduate engineer with foundry experience. He should be able to interpret results and be able to put them into good oral and written form.

He should be assisted by a practical young technician, perhaps drawn from the core room or melting floor, who is not bored by routine work and who is interested in foundry practice. A young girl sometimes meets these latter qualifications admirably but it is probably better to secure an energetic, imaginative young man (22-35) who can get along well with management and labor and who is able to learn to operate and maintain scientific instruments.

The foundry sand laboratory should not be isolated in some office building away from the foundry itself. On the other hand, it should not be placed in surroundings not conducive to concentration. The supervisor of the laboratory and his technician must have access to every part of the foundry and be able to appear at the site of trouble at a moment's notice. The laboratory will have to be equipped with hot and cold water, gas, compressed air, and electricity. Utilities should be kept in mind when planning the site for the laboratory. Air conditioning makes the laboratory a better place in which to work but usually it is not required.

The type of laboratory equipment needed depends upon the type of foundry which is being serviced. However, certain pieces of apparatus are essential regardless of the metal cast in the foundry. Listed below are the

various pieces of equipment which should be in every sand laboratory if it is to function properly.

1. *A core baking oven.* If any cores at all are being made in the foundry, this piece of apparatus is absolutely essential. It is probably one of the most expensive pieces of equipment which will be purchased and much care should be taken in buying it. It is best to simulate foundry conditions when purchasing laboratory equipment, therefore the core baking oven should be the same type as is used in the foundry.

Naturally, it should be small enough so that it can conveniently fit into a laboratory yet large enough to bake at least 100 standard tensile cores uniformly. It may be either gas-fired or electrically heated and should be provided with an automatic temperature controller, preferably of the recording type. It should have a maximum working temperature of 550 F, be well insulated, and the temperature uniform throughout the oven.

2. *Sand mixer or muller.* This piece of apparatus should simulate production conditions. There are several excellent laboratory mixers on the market from which to choose. The laboratory mixer should have a capacity of not less than 25 lb of sand so that enough specimens may be made from each mixture.

3. *Mechanical sieve shaker.* Although many foundries perform their screen analyses by hand sifting, duplication of results is extremely tedious unless a mechanical shaker is used. A shaker with an automatic timing device regulating the time of sifting is advisable. The nest of screens should include those from U. S. Series No. 20 through 270 and Pan, inclusive.

4. *Universal sand testing machine.* Most of the laboratory results will be procured through the use of this instrument and it is better to have one which is electrically driven than one manually motivated.

5. *Sand rammers (two).* The sand rammers made according to American Foundrymen's Association's standard are another piece of fundamental apparatus. It is best to have two of these devices in order to eliminate the time consumed in changing from one type of plunger to another.

The two main types of specimens used in sand testing are the cylindrical compression specimen and the hourglass-shaped tensile specimen. Although the plungers are interchangeable on the sand rammers, it is advisable to attach the tensile plunger to one, leaving the other rammer for the compression specimen.

6. *Permeability meter.* The instrument and accessories for measuring permeability are essential in the foundry laboratory.

7. *Tensile strength core accessory.* This apparatus includes all the necessary parts for making tensile strength cores; should be purchased with sand rammer.

8. *Moisture tester.* The moisture content of molding and core sand mixtures is of utmost importance and the rapid moisture testers now on the market provide an easy means of obtaining these data. Of course, small quantities of the sand mixtures may be weighed, dried and reweighed but the time consumed and the extra handling of the sand makes it worthwhile to purchase a rapid moisture tester.

9. *Compression instrument.* If a great deal of work is going to be done in the measuring of green strength of core sand mixtures, the use of a Saeger-type compression tester is advised. Although green core sand may be tested for compression values on the universal sand strength machine, it is much easier and more accurate to determine the green compression strength with a spring-type tester. Molding sand green compressive values are satisfactorily obtained on the sand strength machine.

10. *Rapid sand washer.* This piece of apparatus may be purchased or made in the shop.

11. *Core hardness tester.* This small gauge is indispensable for the foundry laboratory and for testing production cores.

12. *A laboratory drying oven (maximum temperature 350 F).* A small oven of this nature is often used in the foundry laboratory for drying sands prior to testing and for evaporating the moisture from cereal binders, clays, etc.

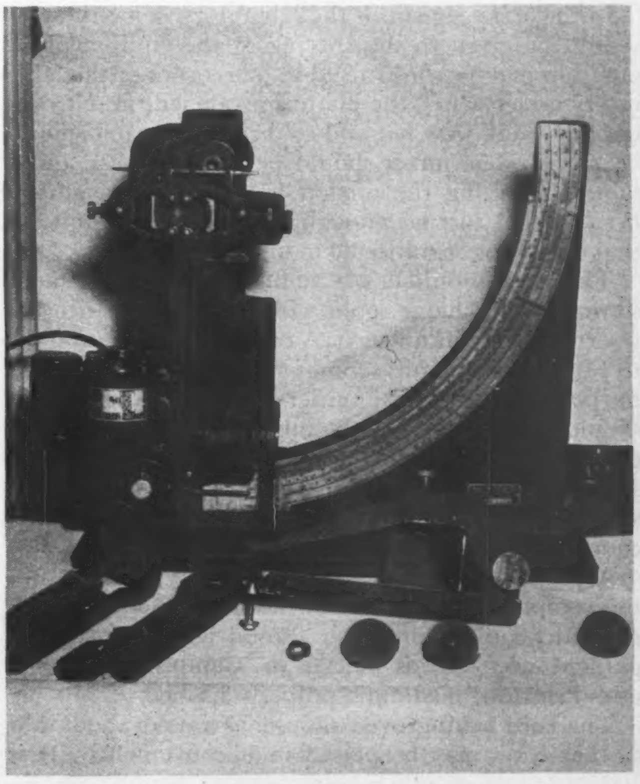
13. *A torsion balance and weights.* The necessity for an accurate, rapid means of weighing sands and binders for testing is obvious. The torsion balance is used for performing screen analyses and for weighing binders when making experimental mixtures.

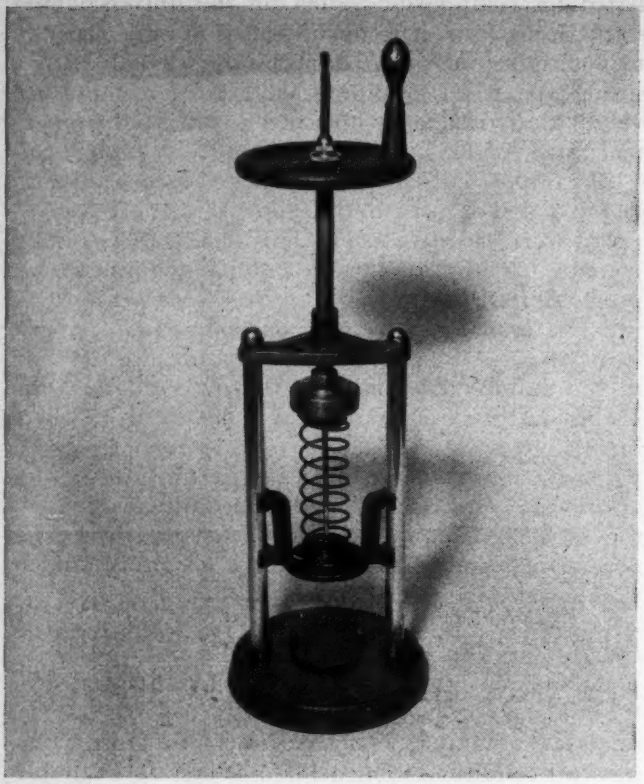
14. *Muffle furnace.* This piece of equipment is usually found in one of the other laboratories in the plant and may not have to be purchased specifically for the sand laboratory. However, its main use is in igniting sands and sometimes in studying them under high temperature conditions when a dilatometer is not available. A large capacity heavy duty muffle furnace is advisable.

15. *Scale.* Some means must be provided for weighing comparatively large quantities (25 lb) of sand. An accurate platform scale meets these requirements.

The instruments on this list should not cost more than 1500 dollars and are essential for the proper functioning of a laboratory. Other pieces of equipment such

A universal sand testing machine for testing the various strengths of all rammed sand mixture specimens.





Compression tester used to test unbaked sand in compression—an important factor in holding sand in mold during assembly of cores in practical foundry operation.

as sand samplers, mold hardness testers, dry core permeability tubes, transverse strength core accessories, gas determinators, flowability indicators, sinter meters, dilatometers, etc. may be purchased as the need arises. A small supply of laboratory glassware should be obtained, although most of the work is done with the core and molding sands themselves.

In the arrangement of the laboratory, some thought should be given to the spacing of the equipment. A sand bin may be constructed in one corner of the laboratory under which the platform scale will fit. Next to the bin a sink with hot and cold running water should be placed. The mixer should be near the sink and a table containing the torsion balance and weights is best situated just far enough away from the mixer so that it will not be subjected to undue vibration.

The mixer should be placed high enough off the floor so that the discharge spout will not interfere with the insertion of a pail under it. A concerete foundation (3/4 to 1 ft high) with bolts set in is admirably suited for this purpose. An electrical outlet (preferably 220 volts) should be provided for the mixer. It is best to have a grounded electrical plug at or near the sink to facilitate safe clay analyses. To save steps, it is well to have the sand rammers mounted near the sand mixer on firm concrete pedestals approximately 3 ft high.

A preparation table should be situated nearby for the compression instrument, moisture tester and permeability meter. This table should be equipped with gas and electricity as well as air. Compressed air is a useful cleaning medium if properly applied.

The core baking oven should be raised about 4 ft so that cores may be placed in it conveniently. It is advisable not to have the baking oven too close to the sand mixer since the heat from the oven may dry out the sand during mixing. If the oven is of the gas-fired type, it will be necessary to provide an outlet for the fan or blower.

A large table for the universal tensile strength and sand testing machines, drying oven, and muffle furnace should provide enough room for tabulation of data and storing of cores before testing. It is well to have at least two large desiccators on this table for the storage of specimens before testing.

The automatic sieve shaker may be placed anywhere in the room, but preferably located near the scale and weighing table. If a ro-tap machine is used, a foundation must also be provided for this piece of equipment otherwise the vibration will be transferred to other pieces of apparatus.

Once the equipment is in the laboratory, it is necessary to become familiar with the instruments. This means learning the calibration of the various devices, the method of making them function most proficiently, and a general knowledge of the working parts. Once this has been accomplished, duplication of individual results is more likely.

Many of the variables in sand research and control have been standardized or eliminated by the American Foundrymen's Association. However, others still exist and these are a problem for individual laboratories. The core baking oven must be investigated. Cores from the same type of mixture must be rammed and baked in the oven in different times and temperatures in order to be assured of complete uniformity. Tests like this are apt to become tedious but are absolutely necessary so that future results may be properly interpreted.

Slight adjustments such as air intake, type of flame in the case of a gas burner, rheostat adjustment in the case of an electric oven, are of the utmost importance and must be carefully controlled and standardized.

Filing Methods

The materials to be used in the laboratory must be studied. Complete knowledge of the sands, binders, washes, etc. is imperative. While the testing of this nature is being accomplished, at the same time the foundry is being aided through the compilation of important data.

A method of keeping and filing data must be set up. The organization of a filing system for foundry sand data is complicated and much study should be devoted to it in order to find out which type will best suit your needs. Probably a cross reference system is the best so that one may find, for example, "bentonite" not only under "clay binders" but also under "synthetic molding sands" and "mixtures."

In the last analysis, the best thing to do is to standardize within the laboratory before advising production supervisors what is wrong with their procedures. The duplication of results in the laboratory is imperative and requires a great deal of tedious work before accomplishment. Naturally, one has to use imagination or good common sense in the interpretation of the results.

For instance, in breaking a tensile specimen, the result need not be 34.5 psi for every specimen made in a mixture but if the results should vary between 20.1 and 56.3 psi, a repetition of the test is necessary.

FLUXES—DEGASIFIERS GRAIN REFINERS

ALUMINUM CASTING ALLOYS

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PRINCIPAL DEFECTS occurring in aluminum alloy castings and which must be overcome by the use of a flux are oxide or non-metallic inclusions, porosity due to gas absorption, and excessive grain size. Fluxes are also used as liquid covers to reduce losses on melting.

Oxide inclusions are caused by the oxidation of the metal during melting. They are also carried into the metal with foundry scrap and from the sides and bottoms of dirty crucibles or pots. Metal containing a considerable amount of oxides will pour sluggishly and the castings may be a dull gray in color. A metallographic specimen will show the inclusions to have jagged edges and they will vary in size, usually being distributed at random throughout the casting. The non-metallic inclusions commonly found in aluminum melts are dirt, stones, pieces of crucibles and bricks, etc.

Gas inclusions are caused by the absorption of gas into the molten aluminum. Most liquids dissolve less gas with increasing temperature, but liquid metals depart from this theory and dissolve more gas as the temperature is increased. Hydrogen is the principal gas absorbed by aluminum, with carbon monoxide, carbon dioxide, methane, oxygen and nitrogren being present in lesser quantities.

These gases are picked up from the products of combustion of the fuel, from the atmosphere, and they may even be introduced by the alloying metals. Badly gassed metal may be recognized by observing the tops of the sprues and risers. The surface usually is rough due to the bursting of gas bubbles which are evolved at the moment of freezing. As distinguished from oxide inclusions, a metallographic specimen will show the gaseous inclusions to be concentrated at the grain boundaries, rounder in shape and more uniform in size.

Large grain size, while not detrimental in all cases, usually is caused by overheating the aluminum. A large grain size will result in lowering tensile strength and ductility, particularly when the casting is cooling through the hot short range where cracking is liable to result. Also, a large grain size is detrimental to castings which must resist pressure and hold liquids.

The characteristics and properties of fluxes vary greatly, depending upon their chemical composition and physical form. The various types of fluxes may be classified as follows:

1. Metallic fluxes, or fluxing alloys; (a) those used principally as deoxidizers; and (b) as grain refiners.
2. Metallic salt fluxes; (a) those used as liquid covers to prevent oxidation; (b) chemical fluxes or those used to dissolve oxides; (c) volatile fluxes or those which separate oxides and non-metallic impurities from the melt by mechanical action.
3. Gaseous fluxes; (a) inert gases which remove oxides and other non-metallic impurities and gas largely by mechanical means; (b) active gases which remove oxides, non-metallic impurities and gas both by mechanical and chemical action.

Metallic Fluxes as Deoxidizers

Any substance, to be effective as a deoxidizer, must be capable of reducing metallic oxides to the metal. According to theory, any metal in the electromotive series of the elements is capable of reducing the oxide of any metal below it in the series. Copper and nickel, being comparatively low in the series, are effectively deoxidized by such elements as manganese, magnesium, calcium, silicon, etc.

Aluminum, on the other hand, is near the top of the series, and is not so readily deoxidized. Several metals have been used as deoxidizers, including calcium, magnesium and cerium. To be effective they must be plunged below the surface of the aluminum about 5 min before pouring. To obtain best results they should be added as hardeners containing from 10 to 50 per cent of the desired element alloyed with aluminum. In many aluminum alloys, however, these additions are detrimental to the physical and mechanical properties and, since there are more effective ways of removing oxides from aluminum, they are not widely used.

Fluxing Alloys as Grain Refiners

Among the various elements which have proved effective as grain refiners for aluminum are titanium, boron, columbium, vanadium and zirconium. Of these, titanium and boron are the most effective and the most widely used, the other elements usually being added for patent reasons. All of these grain refiners have high melting points and are, therefore, furnished as aluminum hardener alloys, containing from 2 to 5 per cent of the high melting point element to enable melting at the ordinary pouring temperature of aluminum.

Pure titanium, for example, has a melting point of 3272 F. A 2½ per cent titanium-aluminum alloy has a melting range from 1229 to 1865 F, and it is readily apparent that it will dissolve in the molten aluminum at ordinary pouring temperature. Titanium is used primarily in the aluminum-copper alloys. From 0.1 to 0.2 per cent should be added just before pouring and

thoroughly stirred into the liquid metal. Titanium will not only impart a fine grain size, but will also increase the fluidity of the metal and the tensile strength and ductility of the castings. As a result of the refined grain size, the castings will have increased resistance to pressure and will hold liquids without leakage.

Boron is being used in the aluminum-silicon type alloys, and only 0.008 per cent boron need be added to produce the desired grain refinement. It may be added in the same manner as titanium and will promote the same properties. The mechanism of grain refinement is believed to be due to the solidification at high temperatures of such compounds as $TiAl_3$, which act as a solidification nucleus for the rest of the melt.

Salt Fluxes as Melting Covers

Fluxing covers are employed in aluminum metallurgy to protect the metal from the furnace atmosphere. As used in practice, they cover the molten metal and reduce oxidation and gas absorption. The composition of the flux must be such that it will be liquid at the melting point of the aluminum and have a lower density than the molten aluminum.

These fluxes usually contain a proportion of the chemical flux so that they will act as a metallurgical slag and dissolve aluminum oxide as well as form a protective cover. Sodium chloride is the base used in most fluxing covers, but it must be mixed with other salts in order to lower its melting point. Several of the common mixtures include 85 per cent sodium chloride, 15 per cent calcium fluoride; 70 per cent sodium chloride, 30 per cent calcium chloride; also mixtures of salt and cryolite and salt and borax.

Various mixtures of the halogen compounds of the alkaline and alkali earth metals may be used as chemical fluxes to dissolve aluminum oxide. However, the most important fluxes in this category are the fluoride salts and double salts. Uusually, they are used in mixtures with sodium chloride or other cheap chlorides to reduce the cost. Most widely used are sodium fluoride, calcium fluoride, cryolite and aluminum fluoride.

Many of the patented fluxes on the market today are mixtures of these salts and, if used according to directions, they will work quite well in removing oxides and suspended matter. They usually are added to the molten aluminum just before pouring, being plunged beneath the surface of the metal with a suitable tool. Fluorine gases will then be liberated, which will give rise to upward currents, thus forcing suspended matter and oxides to the top of the bath. In addition, the liberated fluoride will combine with the aluminum to form aluminum fluoride, which has a direct solvent action on aluminum oxide. About ½ lb of flux to 100 lb of molten aluminum usually is sufficient.

Volatile fluxes are known as such because they volatilize or disassociate below the ordinary melting temperature of aluminum. Unlike the chemical fluxes which dissolve oxides, the action of the volatile fluxes is largely mechanical. When introduced into a bath of molten aluminum, they volatilize rapidly and set free gases which give rise to upward currents and force oxides and suspended matter to the top. They also have the property of separating the metal from the dross at the surface, yielding a fluffy dross which may be skimmed off. They are used in about the same manner and proportions as the chemical fluxes.

The more commonly used salts which are classed as volatile fluxes include zinc chloride, ammonium chloride, magnesium chloride and aluminum chloride. Their principal disadvantages are that they smoke violently when applied to the metal, and will introduce certain undesirable impurities into the metal.

The action of fluxing with an inert gas is largely one of mechanical agitation. This method is effective when castings must be free of pinhole porosity due to absorbed gases. The gas is introduced at the bottom of the melt by means of a perforated pipe or other suitable tool. In rising to the surface of the metal, the gas will accomplish several functions. The bubbles will adhere to slag and dross particles and bring them to the surface of the metal, where they may be skimmed off. Also, the relatively large bubbles of inert gas will diffuse with the absorbed gases and entrapped gases in the molten aluminum and carry them to the surface.

Dry nitrogen gas generally is used in this process, since at low temperatures its solubility in aluminum is practically negligible. Directions for its use may be secured from any manufacturer of nitrogen. In brief, the pressure of the gas should be just sufficient to cause a gentle bubbling, and the temperature of the aluminum should be low so as to avoid reaction of the nitrogen with the metal. The volume of nitrogen required is about 1 cu ft per 100 lb of metal. It would require about 25 min to flux a 1000-lb melt. It is absolutely essential that gaseous fluxes be free of water vapor and hydrogen or more harm than good will be done.

Chlorine gas and boron chloride gas are the two active gases most widely used for fluxing aluminum. Impurities are removed not only by mechanical agitation, but also by combination with the impurities present in the melt. Chlorine gas, for example, will combine with absorbed hydrogen in the melt to form hydrochloric acid, which volatilizes off. It also will combine with the metallic oxides to form chlorides, which also escape from the melt by volatilization.

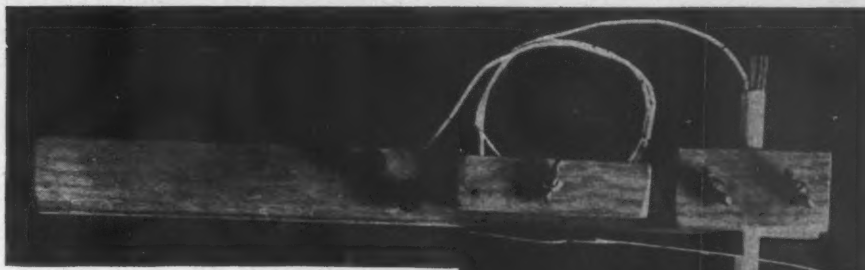
In practice, chlorine gas is introduced by the same procedure as hydrogen, proper precautions being taken due to chlorine's toxic nature. One disadvantage in connection with the use of nitrogen and chlorine as fluxing agents is that they have a tendency to increase the grain size of the metal.

Boron chloride gas reacts in much the same manner as chlorine and, in addition, a marked decrease in grain size is noted for such alloys as No. 195 and No. 356. This is due to the introduction of boron into the melt, the function of which has been discussed.

It is apparent from the foregoing discussion that a given compound or flux may fall into more than one class, depending upon its composition and the function which it is to perform. Most fluxing covers will have some chemical solvent action on aluminum oxide, and some of the chemical fluxes will disassociate and give rise to gases in much the same manner as the volatile fluxes. Volatile fluxes, on the other hand, will often have some chemical action.

IMMERSION THERMOCOUPLE

Simplified Protection Tube



W. A. Spindler
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Ann Arbor, Mich.

Immersion thermocouple assembly.

WHILE OPTICAL pyrometers are satisfactory for most temperature measurements of molten cast iron, their use is subject to certain limitations and inconveniences. Among these is the difficulty, due to interfering gases, of taking the temperature of the molten metal in the electric rocking furnace. Also, while following the drop in temperature of the metal in the ladle, when it is desired to pour at a certain temperature, it is tiresome to use the optical pyrometer for numerous successive readings.

To facilitate and improve the accuracy of temperature measurements in these applications, an immersion thermocouple arrangement has been devised in the university laboratory, as shown in the photograph. It is apparent that no refinements of construction have been made, primary interest having been centered on utility.

Protection Tube

The feature of interest in this thermocouple assembly is the protection tube, which consists of a piece of refractory porcelain tubing into the end of which is cemented a short piece of fused silica tubing that has its outer end closed for immersion into the molten metal. The inside diameter of the porcelain tube is approximately 5/16-in. and its wall thickness about 1/16-in., which has been found to provide adequate strength for lengths up to 24 in., the maximum length required in this laboratory.

The silica tube that is immersed in the molten metal is kept as small in cross section as possible, in order to minimize its "heating-up" time and thereby improve the rapidity of response of the thermocouple. The smallest fused-silica tube having adequate strength at 2850 F (1575 C) has been found to be one with 5/32-in. inside diameter and 1.2 mm. wall thickness, and of transparent quality. The length of the tube in use at present is 3½-in., of which ½-in. is inserted into the end of the porcelain tube for making the cemented joint.

The remaining length permits a depth of immersion into the molten metal of approximately 2½-in. While no tests have been made to determine whether this depth of immersion is sufficient for highest accuracy, the shortest practicable length is being used to keep the amount of this relatively expensive tubing to a minimum.

The connection between the silica and porcelain tubes is made, using a finely ground refractory cement, by coating the external end of the former and the interior of the latter over a length of approximately ½-in. with a rather thin cement and water mixture.

Upon insertion of the silica tube into the end of the larger porcelain tube the space between them is almost completely filled with the cement, and the joint is completed by adding externally a small amount of cement which fills the remaining space and builds up a fillet.

The refractory cement used requires an air-setting period of several hours, and then is fired over the full heat of a Meker burner to develop its ceramic bond. While the cement hardens to make an entirely adequate joint, it remains friable during use to the extent that a used silica tube can be removed from the porcelain tube and replaced with a new one. Thus the porcelain tube can be used repeatedly with the loss of only a small portion from the heated end which deteriorates due

to thermal shock and breaks away with silica tube replacement.

It is apparent, therefore, that the porcelain tube will not withstand immersion in the molten metal, and care must be exercised in using the thermocouple that the porcelain be kept at least ½-in. away from the metal. However, the porcelain tube will withstand insertion into the melting furnace while measuring the metal temperature before tapping, in which case the tube becomes highly heated and will deteriorate more rapidly than when used in the open for measuring temperatures in the ladle.

Couple Wires

The platinum-10 per cent rhodium thermocouple wires are of 28 gage and are threaded through double-bore porcelain insulators. The original length of the couple wires was 5 ft., and the length in excess of that of the protection tube is looped on the wooden handle of the instrument, as shown in the photograph. This extra length of the wires is to permit of cutting off and rewelding the hot junction as it deteriorates and loses calibration.

Two of these thermocouple assemblies are in use so that when one becomes damaged the second is always in readiness. A thin metal shield, with a hole to accommodate the porcelain tube, is screwed to the plywood handle to prevent charring by radiated heat.

Compensating lead wires, about 15 ft. long, are used to connect the thermocouple to a portable potentiometer fitted with a scale reading directly in degrees of temperature. The potentiometer has a cold junction compensator for manual adjustment of the cold junction thermometer reading.

In operation the silica tube and the tip of the porcelain tube are first preheated over three closely spaced Meker burners. While this preheating is not entirely essential, it has been found necessary to keep the silica tube heated over the burners between immersions to avoid cracking of the tube usually occurring when it is allowed to cool to room temperature after having been immersed in molten metal in the furnace.

The reason for this cracking is that the outer layers of the silica tube react with the rather basic iron oxide film and slag on the molten metal, and this contaminated layer has a different coefficient of expansion than that of the body of the tube. The resulting cooling stresses developed within the tube as it becomes brittle at lower temperatures are sufficient to crack the tube. Each silica tube, if kept heated, will withstand upward of ten immersions before it fails at the slag line from reaction with contaminants picked up from the molten metal.

Upon insertion in the melt the couple comes up to temperature in about 10 sec., and it is sufficiently sensitive to readily follow the cooling of the metal in a ladle for control of pouring temperature. The two couples in use in this laboratory have had upward of 200 immersions in molten gray iron, varying from 10-sec. to 2-min. intervals without noticeable change of calibration, at temperatures of between 2875 F (1575 C) and 2600 F (1425 C).

Checking Couples

About 2 in. have been removed from the hot end of each couple, due in one case to mechanical damage and in the other to the melting of one wire which occurred in very hot metal without damage to the silica tube. These two work couples are checked from time to time against a standard couple at temperatures up to 2750 F in a globar furnace.

The development of this thermocouple assembly was the outgrowth of a desire to simplify the more complicated designs reported in the literature [1, 2, 3, 4] that were constructed for other applications, but all of which used fused silica for the protection tube that is immersed in the molten metal.

References

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2. L. F. Weitzenkorn, "A Method for the Determination of Bath Temperatures," *Electric Furnace Steel Proceedings,* AIME, pp. 143–150 (1944).

3. R. C. Tucker, "The Immersion Thermocouple in the Gray Iron Foundry," *Foundry Trade Journal,* vol. 75, no. 1497, April 26, 1945, pp. 335–341.

4. Hunter, Parkes, and Dews, "Temperature Measurement by Means of an Immersion Pyrometer," *Foundry Trade Journal,* vol. 78, no. 1535, Jan. 17, 1946, pp. 53–60.

Cost Committee Serves Association Members

APPOINTMENTS to the Foundry Cost Committee have been announced by Committee Chairman R. L. Lee, Grede Foundries, Inc., Milwaukee.

George Tisdale, Zenith Foundry Co., Milwaukee, has been named Secretary.

Other members are: Wm. A. Gluntz, Gluntz Brass & Aluminum Foundry Co., Cleveland; C. S. Roberts, Dodge Steel Co., Philadelphia; N. J. Schmidt, Gunite Foundries Corp., Rockford, Ill.; and C. E. Westover, Westover Engineers, Milwaukee.

Appointed to Chemical Analysis Committee

K. J. JACOBSON, Griffin Wheel Co., Chicago, has been appointed Chairman of the A.F.A. Chemical Analysis Committee.

Others named to serve on this committee are: M. Ralph Berke, consulting chemist, Ottawa, Ont.; F. J. Boxmeyer, Northern Malleable Iron Co., St. Paul; B. J. Grimm, Twin City Testing & Engineering Laboratory, St. Paul; Carl Johnson, Minneapolis Electric Steel Castings Co., Minneapolis; A. H. Lewis, Dominion Engineering Works Ltd., Montreal, Que.; and J. P. McAvity, T. McAvity & Sons Ltd., St. John, New Brunswick.

Issue Defect Study

CASTING DEFECTS familiar to every foundry are discussed in the *Atlas of Defects in Castings,* prepared by a subcommittee of the Technical Council, Institute of British Foundrymen, and included in the atlas are numerous illustrations of the defects, accompanied by brief statements on causes and remedial measures.

The continued interest of British foundrymen in the production of better castings is reflected in the appearance of the publication.

PATTERNS FOR PRODUCTION

Cooperation, serving to unify the efforts of patternmaker, engineer, and foundryman, is of tremendous value in advancing the castings industry. Paper presented before the Northwestern Pennsylvania Chapter of A.F.A.

John E. Gill
Lake Shore Pattern Works
Erie, Penna.

IT IS CUSTOMARY to think of the patternmaker as a craftsman who makes in wood what the engineer has drawn on paper. That concept is true, but hardly complete, since materials for making patterns go far beyond wood, and often a patternmaker finds that his knowledge of foundry practice makes his opinion valuable to the engineer in designing a practical casting.

Pine still is the basic pattern material and, as most foundrymen know, mahogany is used in patterns which must stand moderately high production requirements. Since the shortages of pine and mahogany during the past few years, cherry has been found to be an excellent wood for many types of patterns. Cherry is very hard, and has been found to stand up better than mahogany under foundry conditions. However, a patternmaker should not be asked to carve odd-shaped designs in cherry. Its very hardness makes it difficult to carve, but excellent for parts which can be turned or sanded.

Plaster Patterns

Many patterns are being made in plaster of paris. The automotive tire industry has found that building up and shaping plaster of paris in making tire molds is a great time saver. The process is called screeding and intricate shapes can be developed with the use of a template arranged to swing on a given radius or to follow a pre-arranged straight edge.

Plaster of paris has been used by most progressive pattern shops for many years as the safest way to obtain an accurate corebox. Since a plaster corebox is not normally suitable for more than a dozen cores, its greatest use is as a master pattern to make an aluminum, magnesium, brass or cast iron corebox. An identical plaster cast can be taken off the same corestick from which the corebox was cast and, with careful workmanship, a core dryer can be made which will support the cores with a minimum of fitting. Such coremaking equipment is used in conjunction with metal pattern equipment, which is a field of its own in variety of types of equipment and varying degrees of accuracy required.

Aluminum, brass, iron, or magnesium patterns can be used as: loose patterns; mounted on pattern boards; mounted on metal plates; mounted on separate cope and drag plates, or cast plates. Normal casting requirements usually are met with aluminum patterns, either mounted on metal plates or cast as an integral part of a match plate.

In past practice, the patternmaker would take a drawing, make a pattern that he thought would be good enough, and from there on it was up to the molder to make the casting. If the mold tore up or the cope dropped or the cores needed filing,

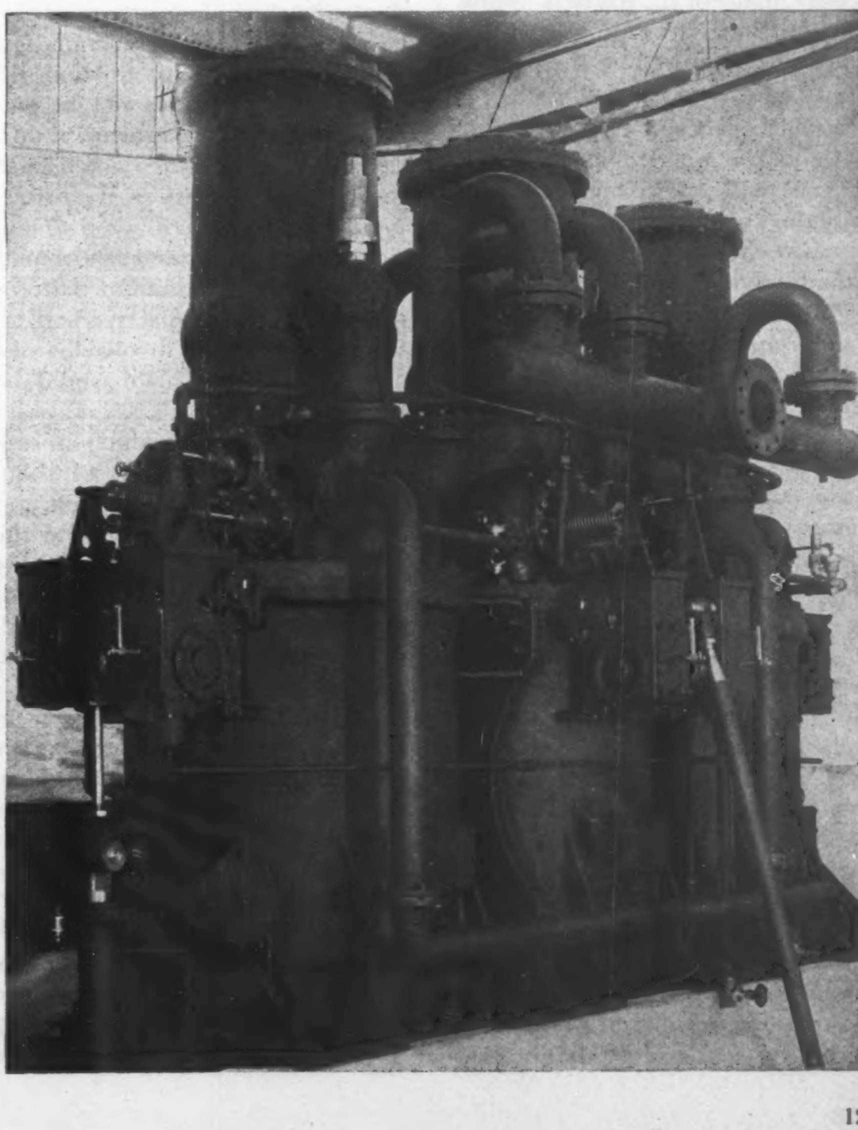

Fig. 1—Low pressure cylinders of this engine were made from one pattern and one set of coreboxes, using combination boxes and loose pieces.

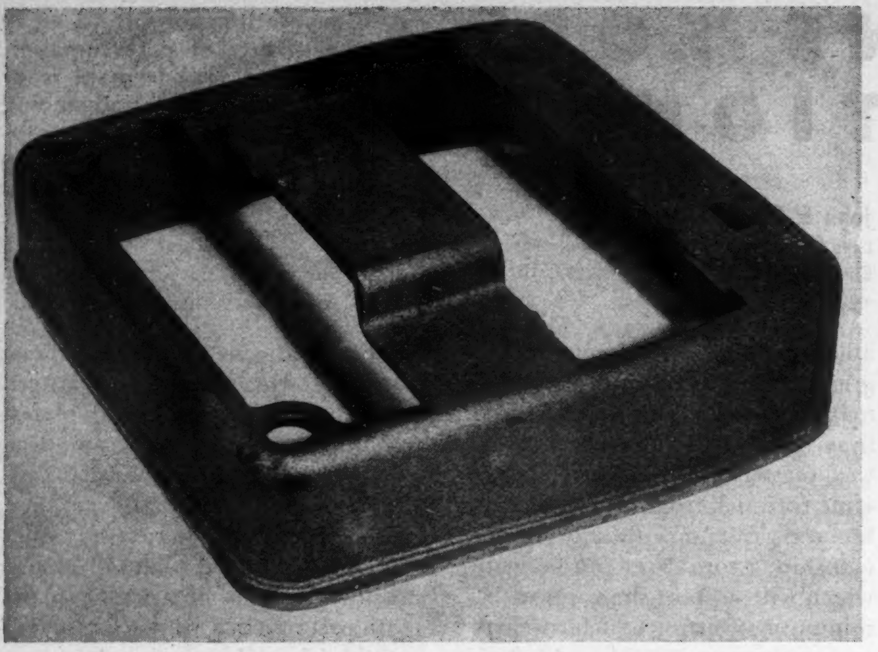

Fig. 2—Placing the strap across the top of this 12-in. casting eliminated the use of the core necessary when strap had been cast across bottom.

that, after all, was the molder's job. Today, many of the molders in production shops are simply molding machine operators, and the pattern must be right for efficient work.

Problems encountered in making patterns for large engine cylinders (Fig. 1) will serve as an example of a method for planning. In order to visualize the problem clearly, it was found advisable to make a one-eighth size model. The problem was to make one pattern and one set of coreboxes from which the right, center, and left cylinders could be made by use of combination boxes and loose pieces. The scale 1½ in. = 1 ft. was used because that was the drawing scale and layouts could be made by tracing directly from the drawing.

Not only did the model help in deciding on the best way to construct the pattern, but it was used by the foundry superintendent to help decide the best way to mold and cast the cylinder. When the engine designer inspected the model, he saw several machining hazards, and several complicated and unnecessary shapes which were simple matters to change at that early stage. Further, the model was found useful as a visual aid in designing the insulation which was to be wrapped around the finished engine. In all, it was a useful model.

In smaller work, such caution is not usually necessary. The main item in small castings is a knowledge of the number of castings required from a given pattern, and then planning the pattern equipment to suit that production. In general, for limited production (10 to 100 castings) the loose pine pattern answers the purpose. Production up to 500 castings would indicate a mahogany pattern, if possible, mounted on a pattern board. Quantities of castings over 1,000 should be made from aluminum patterns mounted on metal plates; where an irregular parting is involved, a cast aluminum match plate would be required.

Equipment for production running into the hundreds of thousands requires special attention, and should be carefully planned by the management of the foundry making the castings. Cope and drag sets of pattern plates usually are indicated, along with gang coreboxes and suitable driers.

At the beginning of the war in Europe, it became evident that the requirements for vises would increase sharply. In order to meet the production required, something had to be done with the pattern equipment, which until that time had been loose hardwood patterns with a parting line to suit the necessity of setting the jaw steel in the drag. After the problem was faced squarely by the engineer, the foundry superintendent, and the author's father—the patternmaker, new equipment was developed.

Split aluminum patterns, machined on all critical dimensions with an arrangement for setting the jaw steel in a core, solved the main difficulty of closing over a straight object sticking into the cope. Aluminum coreboxes, also machined to close tolerances and fitted with core driers, gave uniform cores in minimum coreroom time. The savings to the foundry were in the form of heavy castings on a good production basis, lower scrap losses, and relief from demands for deliveries.

Savings to the vise manufacturer were great. The castings were delivered on schedule. The weight of the castings was reduced because now the molder did not rap the pattern and add three pounds on each casting. With the slight reduction in cost per pound, the pattern equipment cost was absorbed in casting cost saved on the first order of 2000.

Added to this was the standardization of set-up practice in the machine shop. Uniform castings can be set up without shimming, fitting and testing by the machine operator. The metal allowed for finishing was uniformly $\frac{3}{32}$ or ⅛-in., according to a predetermined practice, so that the surfaces could be milled to size with a single machine pass.

Design Change

The 12-in. square sub-base shown in Fig. 2 lent itself neatly to improvement. The strap shown across the top of the present casting was formerly cast across the bottom. This meant that a core had to be used to make the inside of the casting and, when this disadvantage was pointed out to the engineer, he looked into the possibility of making a change. He found that there was no harm in moving the bar to the top face, which allowed the use of a cast plate and resulted in savings to both foundry and fabricator.

The foundry now can produce a quality casting in minimum molding time, so that even at a reduced price per pound a profit is made. The fabricator now receives a quality casting ahead of schedule. The price per pound is less and the weight per casting slightly lower than with the old loose pattern.

NEW LITERATURE

"Machining Aluminum Alloys," a 124-page, spiral-bound, 6 x 9-in. manual, is now available, at one dollar a copy, from Reynolds Metals Co., Department 47, 2500 So. Third St., Louisville 1, Ky. Featured are eight data charts containing recommendations for eight machining operations. Another section discusses machining characteristics of aluminum alloys, and nine chapters offer information on tooling, feeds, speeds, and cuts coolants.

In a new pictorial booklet, "Learn Arc Welding," Hobart Trade School, Inc., Troy, Ohio, describes the courses of study offered at the institution.

In a new 23-page illustrated booklet, "AAF in Industry," American Air Filter Co., 215 Central Ave., Louisville 8, Ky., offers information on various types of industrial dust problems and typical installations of its air filtration and dust control equipment. Included are charts showing size and characteristics of air-borne solids and sections dealing with filtered air for industrial ventilation; drying operations and product finishing.

In an attractive, three-color folder, Automatic Transportation Co., 69 W. 87th St., Chicago 20, introduces its "Skylift" automatic electric truck. Construction and mechanical features are described and complete specifications listed. The firm also offers the loan of two materials handling films, "Pay Loads Pay Off" and "Skylift Newsreel."

Products of the Columbia Chemical Div., Pittsburgh Plate Glass Co., Fifth Ave. at Bellefield, Pittsburgh 13, Pa., are described in a series of attractive folders available from the firm. Properties, applications and forms, are listed for caustic soda; soda ash; caustic ash; liquid chlorine; sodium bicarbonate; modified sodas, and the company's line of cleaner.

"The News Letter" of American Wheelabrator & Equipment Corp., Mishawaka, Ind., lists the products for which literature is made available by the company.

"Drying of Foundry Sands by Dielectric Heat," a technical paper on the application of high-frequency electric fields in foundries, is available from Casein Co. of America, Division of Borden Co., 350 Madison Ave., New York.

An index guide to reports on wartime technological developments in the United States, Germany and elsewhere, titled "Bibliography of Scientific and Industrial Reports," and issued by the Office of Technical Services, U. S. Department of Commerce, Washington, D. C., is now available from that office at 50 cents per copy. Intended for use with the Bibliography, this comprehensive index covers the first 25 issues, from January 11, 1946, through June 28, 1948.

"Practical Information on Dust Collection," Bulletin FY-142, issued by Whiting Corp., Harvey, Ill., is a revised and enlarged edition of an earlier bulletin on that subject. The 16-page booklet covers both technical and general factors, and includes sketches and tables for quick reference. Hoods, orifice loss, pipe resistance, fans, air pressures and other pertinent points are discussed.

"Cash-Acme"—small volume pressure reducing and regulating valves for special installations—is the subject of a new bulletin, No. 199, issued by A. W. Cash Valve Mfg. Corp., 666 East Wabash Ave., Decatur, Ill.

Technical dictionaries, college and other textbooks, and recent works on metals, chemistry, physics, general science and technology are listed in the 1947 catalog of Chemical Publishing Co., 26 Court St., Brooklyn 2, N. Y.

Facilities, practices, products and personnel of Grede Foundries, Inc., Milwaukee, are presented in an unusually attractive, profusely illustrated brochure, A Quarter Century of Foundry Progress. Text and pictures constitute a review of foundry operations and a clear portrayal of the importance of foundryman's role in industry.

Magnetic crane controls are described in a new 20-page booklet, B-3853, issued by Westinghouse Electric Corp., Pittsburgh 30, Pa. Descriptive information, wiring diagrams, performance curves and guide to type of a-c control best suited to a job, are included.

Specifications and construction features of "Monarch" brand transmission belting are outlined by Hewitt Rubber Div., Hewitt-Robins, Inc., 240 Kensington Ave., Buffalo 5, N. Y., in a new four-page product folder. Applications in foundries, mines, quarries, etc., are cited.

The new and improved "Falk Type F Steelflex Couplings," and eight other types of couplings produced by the firm, are described in Bulletin 4100, issued by Falk Corp., Milwaukee 8. Simplified selection tables for motor and turbine applications are provided.

An analytical study on "Employee Feeding Earns a Profit . . . True or False?" has been completed by Richardson Wood, industrial analyst, New York, for Crotty Brothers, Inc., 137 Newbury Street, Boston 16, industrial restaurant operators. Ring-bound and well illustrated, the booklet describes the effects of employee feeding on employee relations, absenteeism, and accidents notes.

Dust collectors are the subject of Bulletin No. 1128, a 72-page booklet issued by American Blower Corp., Detroit. Operating principle and design, fields of application, efficiency factors and representative performance data are given. Selection charts, dimensions of single collector units and of group arrangements, application factors, and general design data are also shown.

Data on caustic soda, its properties, characteristics, forms, constants and applications, are available to the engineer, technician and executive in an elaborate, three color, profusely illustrated booklet of 72 pages, issued by Columbia Chemical Div., Pittsburgh Plate Glass Co., Fifth Avenue at Bellefield, Pittsburgh 13, Pa. Numerous photographs, as well as technical charts tables and graphs, are included. Methods of manufacture, purification, and handling, are also described in the text. Requests for copies should be on company letterhead and should specify "Form A-100."

In "Facts for Foundrymen," sixth edition, Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Buffalo, N. Y., offers a foundryman's handbook, containing data on aluminum and brass alloys, cast iron, copper, malleable iron, nickel and lead. Also given are SAE specifications, and tables on volume and weight conversion, weights of common alloys, weights of common materials and liquids, and metric conversion. Available from the company, $1.00 per copy.

Technical information on aluminum alloys is presented in the 248-page "Reynolds Aluminum Alloys and Mill Products Data Book," featuring 106 tables of data. Format is 6x9-in, and the book is wire bound to open flat at any point. Nominal chemical compositions, typical physical properties, values of density of coefficients of expansion, thermal and electrical conductivity, annealing and heat treating cycles for sand-casting, permanent-mold casting, die casting and wrought alloys, are given. Price, $2.00 per copy; available from Reynolds Metals Co., Dept. 47, 2500 S. Third St., Louisville 1, Ky.

In the new "USCO News Casting," U. S. Reduction Co., East Chicago, Ind., offers aluminum foundrymen a monthly digest of news and ideas about aluminum.

Substantial savings are realized by practical applications of the metallic-arc welding method and aluminum-bronze electrodes in joining cast iron and steel, and in rebuilding worn seats in large cast iron valves. Weld areas should be carefully prepared. Critical castings should be preheated and the interpass working temperature maintained.

JOINING DISSIMILAR METALS

Donn Boring
C. D. Peters & Co. of Canada, Ltd.
Montreal, Que., Canada

AN INTERESTING APPLICATION of metallic-arc welding, illustrating the versatility of coated aluminum-bronze electrodes in welding dissimilar metals, was recently reported by a Canadian manufacturer.

An order received by this company called for 24 fin-type radiators, which are used in commercial and domestic heating units. The order specified three-high header units. Only four-high header units were available, however. When an effort was made to secure the required headers from the foundry, it was found that they could not be supplied in time to meet the delivery dates specified on the order.

It was decided that the only solution was to cut down a four-high header to the required size and weld on a steel end plate. The header was cut down on a bandsaw and a $\frac{3}{16}$-in. S.A.E. 1020 steel plate, cut approximately $\frac{3}{16}$-in. smaller than the end of the header, was placed over the end to be closed.

The mild steel plate was then welded to the cast iron header, using $\frac{5}{32}$-in. diameter coated aluminum-bronze electrodes with the metallic-arc. After assembly, each unit was tested for soundness under 300-lb hydrostatic pressure, and all welds were found to be perfect.

This application is only one of many wherein coated aluminum-bronze electrodes can be used to successfully weld a great variety of dissimilar metals. Aluminum-bronze electrodes are also used to provide high strength, bearing, wear- and corrosion-resistant overlays for such applications as valve seats, steel mill guides, and acid pickling handling-equipment parts.

An industrial gas company salvaged the 24-in. cast iron gas valve shown in the photograph by metallic-arc welding with aluminum-bronze electrodes. A considerable saving was realized over the initial cost of a new valve; in addition, the service life was greatly extended.

This gate valve is used in a carburated water gas installation, ne-

Steel end plate is welded (left) into cast iron radiator header. Close-up (below) of the completed weld.

cessitating opening and closing at regular and continuous 3-min intervals. Constant operation subjects the valve seats to a tremendous amount of abrasive wear and erosion, resulting in a normal operating life of only 4 mo. These 770-lb valves have two seats and, in this particular case, both seats were so badly worn that the valve was no longer serviceable.

Original cost of the valve casting, including finish machining, was $130.39. The total cost of reclaiming this valve by welding with aluminum-bronze electrodes, including finish machining, was $66.13.

In preparation for metallic-arc welding of the valve faces, the surface area to be welded was undercut $\frac{3}{16}$-in. to insure removal of all worn and eroded base metal. The surface was then cleaned thoroughly. Before welding, a large gas torch was used to preheat the entire valve to 400 F. The same interpass temperature was maintained during the entire welding operation.

For the initial layer, a soft grade of aluminum-bronze (89 per cent Cu, 10 per cent Al, 1 per cent Fe) electrodes were applied to give a back-up deposit of high ductility. Subsequent layers were deposited with a harder grade of aluminum-bronze (83 per cent Cu, 12.5 per cent Al, 4 per cent Fe) electrodes, producing a deposit of 200 Brinell hardness for wear resistance.

Electrodes of $\frac{3}{16}$-in. diameter were used in depositing the overlays on the one in. wide seats. Down-hand welding with a back-step method was used to minimize distortion in the cast iron valve. A relatively low current was used on the initial layer, with a rapid weaving technique to distribute the heat and prevent deep penetration. The least amount of penetration is desirable in welding iron-base metals with copper-base alloy electrodes. The electrode arc is directed onto the molten weld puddle instead of the base plate in order to obtain a brazing action with the metallic-arc method.

The procedure consisted of weaving the $\frac{3}{16}$-in. diameter electrode across the one-in. face for a distance of 6 in. on the circumference. A new deposit was then started directly opposite in order to distribute the welding heat and minimize stress concentrations. One entire face was surfaced, and then the operation repeated on the opposite face.

The first layer was applied using 165 amperes and 30 volts. Subsequent layers were deposited at 225 amperes and 31 volts. Three layers were required on each face to insure a finished weld deposit thickness of $\frac{1}{4}$-in. The valve was then placed on a positioner and rotated vertically for finish welding the inside edges of the valve faces.

Indications are that the service life of this valve, will be extended from 4 to 12 months under severe conditions of wear and corrosion.

A 24-in. cast iron gas valve was reclaimed by depositing three layers of metal on the worn valve seats.

MOLDING SAND BINDERS

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In this contribution to the theory of binder effects upon the properties of molding sands, the author sets down his own experimental results and experiences and quotes those of other investigators, the purpose being to more completely inform the American foundryman upon the trends of European investigations during the long war-time period.

PROPERTIES of molding sands which are of interest to the foundryman, as given by Dunbeck,[1] are grain size, green, dry and hot compressive strengths, permeability, durability, flowability, moisture content, resilience, expansion, contraction and sintering point.

These properties are needed in different degrees according to use. Naturally bonded sands are always sufficient if they have a certain grain size, permeability, expansion and refractoriness as initial properties. In case naturally bonded sands do not develop the other desired properties, a suitable admixture is made to the sand.

All admixtures, as well as the corresponding substances in naturally bonded sands, have one essential feature in common; they connect the sand grains into a system whose strength, produced by ramming, enables both the mold and the cooling casting to safely sustain the stresses to which they are subjected.

In testing practices these stresses are characterized by the green, dry and hot compressive strengths corresponding to the temperatures resulting from the cooling casting. At the same time these admixtures must produce many other properties in the sands if the sands are to be regarded as suitable for foundry use. This applies to inorganic materials such as clays, and to organic substances used for the production of cores.

Bond Properties and Strength

To achieve a certain coherence among the sand grains, attractive forces must interact. For the coherence of two bodies in the dry state it should be assumed that the largest possible part of each body is in contact with the other and, at the same time, distances between their surfaces are of the same order as the distances between atoms or molecules of the bodies under consideration.

Under these conditions the forces which interact to hold the two bodies more tightly together are greater as the size of the bodies become smaller and as the proportion of surface and weight becomes greater. For inorganic substances these forces are most frequently represented by electrostatic forces between ions or dipols, and for organic materials, without dipolar moments, involved are Van der Waal forces.

The forces producing coherence between silica sand grains are negligible and of no importance because the grains are too large and their surfaces too irregular. The specific task of every binder is to use most effectively the inherent surface forces present upon each sand grain. To fulfill this task every binder should possess the following properties:

(1) It should wet the sand grain surface as much as possible.

(2) The *adhering* forces between binder and sand grain should be as intense as possible.

(3) The *cohering* forces within the binder itself must be of the same order as the forces of (2).

In practice, wetting the sand grains is most frequently accomplished by adding the binder in the liquid state. To obtain the other two conditions, the binder must contain or develop the maximum number of particles of colloidal dimensions. The surface-weight proportion is optimum when those colloidal particles take a plate- or fibre-like form.

Bond clays (inorganic materials) and all water-dispersed organic binders (such as dextrin and starch) used for bonding molding sands contain such colloidal particles. Such colloidal particles develop during the setting of cement and during the baking of organic binders, especially during polymerization of oils such as linseed.

For sands in the "green state" the adhering forces are interacting in the presence of a liquid. These forces function in the presence of water, but little, if any, in the presence of oils such as linseed. In the case of forces active between sand and clay in the green state, we are concerned with the existence and interaction of forces between silica grains and clay, and between the clay particles themselves in water. U. Hofmann and A. Hausdorf[2] have studied these forces of Na-bentonites (electrodialysed Ca-bentonite) with various exchange cations.

In the presence of water the elementary particles of Na-bentonite are surrounded by a diffusion double-layer. In the presence of water the exchange cations (1) try to diffuse through the double-layer and (2) try to separate themselves, aided by an increase in thermic movement, from the negatively charged surfaces of the silica layers of the clay lattice to which they are attracted by electrostatic forces.

Distance From Surface

According to Debye-Huckel's theory, the extent of this diffusion double-layer, i.e., the average distance of the cations from the surface, is given by the quantity $1/k$ with the dimension of length (Fig. 1). The distance depends upon the concentrations of the same cations in the solution, and it diminishes with increasing concentration of the cations.

Also, the average distance separating the ions in solution diminishes with increasing concentration of the cations, but at not so rapid a rate as $1/k$. With greater concentrations, two surfaces can approach so closely that an intermixing of the two diffusion double-layers results. The cations spread equally between both negatively charged

surfaces and bind them as illustrated in Fig. 2.

In order to explain the binding action between silica grains and Na-bentonite, it may be assumed that even the surface of the silica grain contains a small number of exchange cations, so that a mixed diffusion double-layer is formed in the presence of water. In any case, Si-O dipols which, by reason of their electrostatic dipolar forces attract the cations of the diffusion double-layer, are present on the silica surface.

Since only a relatively small amount of water is involved in molding sands, let us consider the extent to which the aforementioned mechanism applies. In this water other cations, usually Ca and Mg, are present along with the Na cation of Na-bentonite. According to Debeye-Huckel's theory, the quantity $1/k$ is true only for monovalent cations when the distances involved are greater than 25 A°. We, however, are interested in distances less than 25 A°.

The aforementioned mechanism is true for not only Na-bentonite but for all clays, and is at least qualitatively supported by the following facts. According to Grim, Bray and Bradley,[3] the green compressive strength of molding sands is dependent upon the amount of exchange cations, and as this strength increases the number of cations increases.

With mixtures of constant Na-bentonite content at increasing moisture contents, the green compressive strength increases at first because the silica grains can be more easily moistened and diffusion double-layers can develop in the clay. As we continue to increase the amount of water, the green compressive strength attains a maximum value, and a further increase in water content brings about a decrease in this strength because the diffusion double-layers are unfavorably changed due to a diminution in the cation concentration.

From this point of view there is no justification for the use of soft water, a practice sometimes recommended when bentonite is used. Laboratory tests (Fig. 3) prove that the green compressive strength of a mixture bonded by Na-bentonite increases slightly in relation to the hardness of water.

Consideration is seldom given to the influence of anions, often regarded as insignificant but which, nevertheless, may be unfavorable. For example, an excessive admixture of 2.3 grams of Na_2SO_4 to 100 grams of Na-bentonite produces a decrease in green compressive strength from 300 g/cm² to 150 g/cm² (4.3 psi to 2.15 psi).

In the case of forces active between sand and organic binders in the green state, the green compressive strength of pure silica sands bonded with organic binders generally is lower than clay-bonded sands, and most frequently this strength cannot be increased by increasing the amount of binder.

Bonding Power

Water-dispersed organic binders have less green bonding power, rarely exceeding 100 g/cm² or 1.4 psi, than clays, and oil-bonded sands have the lowest green compressive strength (20-40 g/cm² or 0.29-0.58 psi). When organic binders are used the interacting forces (Van der Waal's) are different; nevertheless, after drying, a high compressive strength is achieved by mixtures bonded with organic materials, and this strength is at least equal to that produced by clays.

Experience has indicated that a certain increase in the green compressive strength can be achieved by increasing the viscosity of the sand mixture, which is limited by the technical conditions of mixing the sand. Above a certain viscosity the binders do not mix well with the sand and, consequently, the previously mentioned condition of perfect adhesion is not fulfilled.

The influence of adhesion, at a lower degree of viscosity, can be more readily observed in its effect upon the dry compressive strength, rather than the green compressive strength. Since various binders behave differently in this respect, it seems useful to consider the problem of viscosity of organic binders and bond clays at the same time.

Binder Viscosity—Influence on Green Compressive Strength. Assuming that the silica sand grains are uniformly wetted, each grain will be better enveloped by the binder at lower viscosities of the binder. Because of this, some organic binders of high viscosity at room temperature usually are admixed at a higher temperature. It is also well known from practice that the admixing of some binders to the sand depends upon the type of mixing equipment used.

There is a great difference between mixing Na-bentonite in the

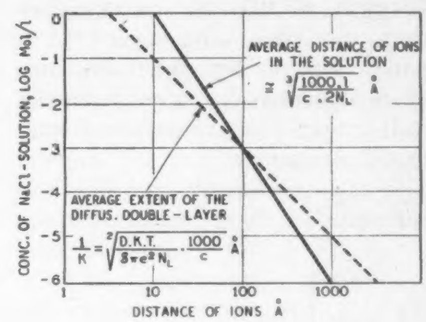


Fig. 1—Relation of average distance between ions in solution and of the average depth of the diffusion double-layer, both with respect to the concentration of NaCl solution.

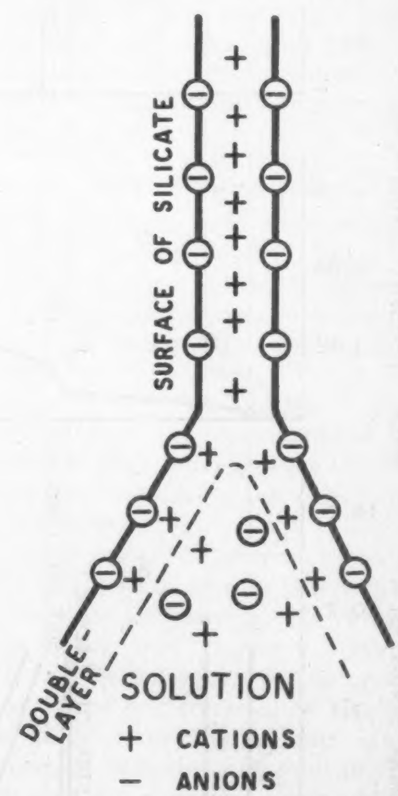


Fig. 2—Uniform distribution of cations between two silicate surfaces of montmorillonite, assuming that a sufficient concentration of the loss is present in the solution.

presence of water by means of a shovel mixer and by means of muller-type mixers. Mixing in the muller-type mixers is accomplished under the influence of higher shearing stresses.

For comparison, Plesinger[4] shows that after mixing in a muller-type mixer a sand containing the optimum admixtures of Na-bentonite and water gave a green compressive strength 20-60 per cent higher and a dry compressive strength 60-300 per cent higher than the same sand mixed by a paddle-type mixer. The influence of shear stresses is evident from the well-known viscosimetry of colloidal substances.

It appears difficult to follow the influence of shear stresses on the viscosity of some binders, especially for large particle clay suspensions at concentrations which occur in their practical applications in molding sands. To the present time, the consistometer of Hophler[5] has been used for this purpose. The suspension to be tested is enclosed in a hollow steel cylinder of known diameter. A body, generally a small ball, is pressed into the suspension under different pressures, and the time measured for the ball to traverse a given distance. Thus the velocity of flowing is measured.

In clay suspensions, especially under large pressures, water is pressed out by the ball and the surface of the ball is lubricated by the water. The amount of water in the suspension changes with the distance traversed by the ball and, consequently, the measured time values change as well. Owing to war conditions it was not possible to introduce a more satisfactory method, and the dependence of velocity of flowing on shear stresses could be measured only for some suspensions, and then only approximately.

The values of viscosity which may be obtained from the curve of flowing are, under these circumstances, significant only for general orientation. The differences between the flow values of the various binders in suspension are so large that they shift into the background the theoretical uncertainties and lack of exactness originating from the testing procedure. However, the flow values obtained do permit us to make interesting conclusions.

Figure 4 shows a summary of results obtained. Figure 4a shows the relation of viscosity to shear stress for some well-known binders (linseed oil, Na-bentonite, etc.) and also for some materials that may come into consideration as binders (Nacel-glyk and ethylcel-ester).

Viscosities of materials such as oils do not depend upon shear

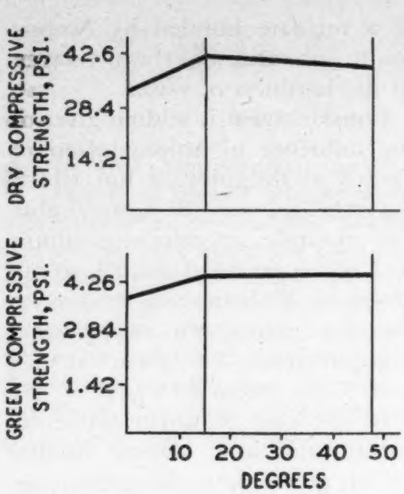


Fig. 3—Influence of the hardness of water on green and dry compressive strengths for a mixture of 5 per cent Na-bentonite and 4 per cent water.

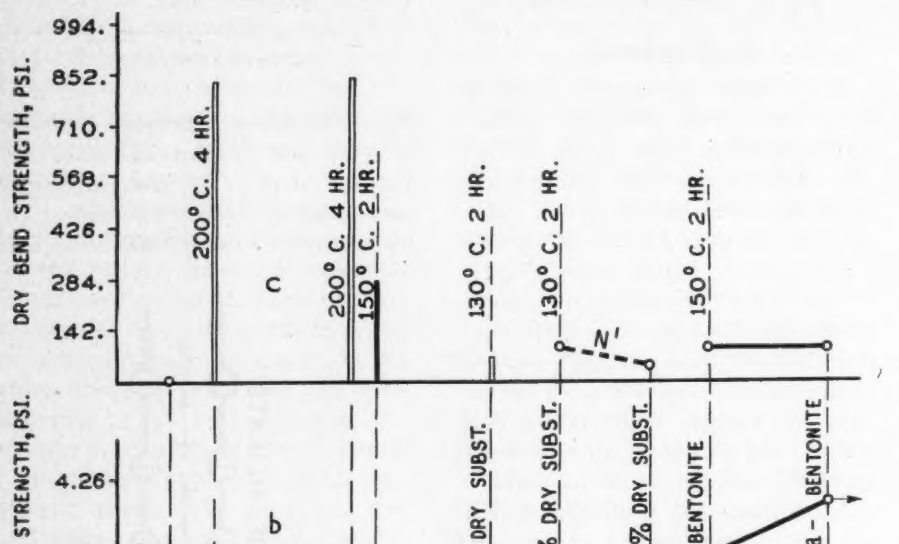


Fig. 4—Relation between viscosity and (a) shearing stress, (b) green compressive strength and (c) dry transverse strength for water, linseed oil, dehydrated caster oil, condensated suphite lye, ethyl-cellulose-ester, sodium-cellulose-glycolate and Na-bentonite.

stresses. Na-bentonite is one of those substances which, when in suspension, exhibits diminishing viscosity with increasing shear stress. This phenomenon is described as structural viscosity or, more generally, as quasi-viscosity. At small shear stresses some binders behave almost like a solid and their viscosities approach infinity.

Figure 4b shows the relation between green compressive strength and the measured viscosity at its maximum value. Figure 4c shows the corresponding values for the dry transverse strength. In all tests the viscosities of the binders were measured for concentrations generally found in foundry sand mixtures, and these concentrations were admixed with the sand. Because of the previously mentioned experimental difficulties, the testing of Na-bentonite suspensions required a relative increase in the amount of water.

In general, for all types of materials, we may assume that their necessary uniform distribution can be achieved only when the viscosity does not exceed a certain limit related to any material in question. When a particular limit is exceeded, the uniformity of distribution necessary for green compressive strength is incomplete and the strength is diminished.

Uniform Distribution

For a binder which exhibits quasi-viscosity, the necessary uniformity of distribution of that binder can be achieved by increasing the shear stress if viscosity at small shear stresses is too large. If at a given shear stress the limit of mixability for any mixer is exceeded by increasing the concentration of the binder, the resulting green compressive strength of the mixture decreases. This is shown in Fig. 4, with sodium-glycolate of cellulose (Curve N, Fig. 4b).

Due only to this influence of shear stress, it is possible to mix the Na-bentonite suspension and to explain the influence of different kinds of mixers upon the achieved strengths according to experience from practice. A lower viscosity achieved by warming results in better mixing of all binders, especially viscous oils, resinous materials and pitch. The warming of certain binders is a general foundry practice.

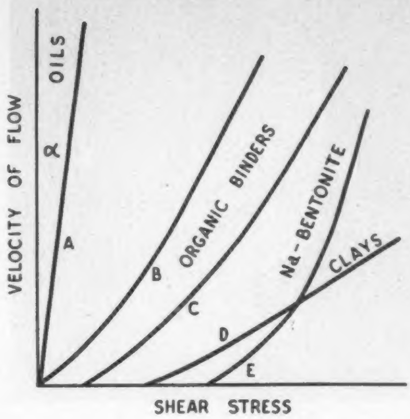


Fig. 5—Schematic representation of the relation of velocity of flowing to shearing stress; various binders.

Figure 4b shows that the relation between green compressive strength and viscosity has more general importance, since this strength usually increases as the viscosity increases. This relation is more evident when we consider the character of flowing, shown schematically in Fig. 5, for various types of binders.

For the coordinate system used in Fig. 5, viscosity is determined from the tangent to the curve in question at any particular shear stress. The curves are of different character and become straight lines for pure viscosity (after Newton) which occurs with water and oil. The curved lines in Fig 5 indicate that, for certain water-dispersed organic binders, viscosity varies with shear stress.

When a curve passes through the origin of the coordinate system, a movement approaching that of flowing occurs at low shear stresses. If the curve begins to rise from a certain shear stress, the binder up to this stress behaves as a solid. The position and character of the curves depend upon the temperature and on the duration of shear stress, as mentioned later in connection with the study of the influence of thixotropy.

Green Compressive Strength

From theoretical considerations, materials which behave as solids up to the greatest possible shear stresses will possess the best properties for the development of green compressive strength; and if at the same time these same materials have the lowest possible viscosity they will possess the best properties for admixing into the sand and for ramming the sand. Figures 4 and 5 show that of the materials mentioned, Na-bentonite more closely approaches theoretical conditions.

Some macromolecular organic substances which exhibit swelling in the presence of water have qualities approaching those of Na-bentonite, and achieve excellent strength after drying. A suspension of Na-bentonite behaving as a quasi-solid material at low shear stress produces a sufficient green compressive strength in the sand; however, at a higher shear stress the viscosity rapidly decreases and the Na-bentonite can be well mixed into the sand.

In this respect other bond clays are characterized by a less favorable behavior, as shown in Fig. 5. It is not possible at present to directly compare the influence of shear stress on the binder alone and a mixture of the binder and silica sand. The sand mixture can be classed as a rough polydisperse system. The influence of the properties of the silica sand, such as grain size, grain distribution, and form and quality of the grain surface is evident.

Binder Concentration

A pure silica sand mixed with a purely viscous binder (such as shown by curve A, Fig. 5) shows a certain green compressive strength, however small. The sand mixture behaves as one system, according to curve B or curve C of Fig. 5, provided that the concentration of binder does not exceed a certain limit above which the sand mixture flows.

The individual characteristics of the binder can best be observed by watching the movement of grains in "green sand" during a pressure test. The movement of the grains would be best recorded by filming. Figures 6 to 9 show the more viscous behavior of sand-alkylin system (mixture) as compared to the sand-(Na-bentonite) system.

The influence of various amounts of different clays upon silica flour relative to the coefficient of internal friction has been studied by

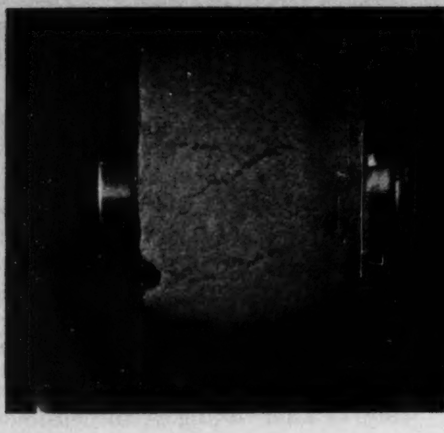
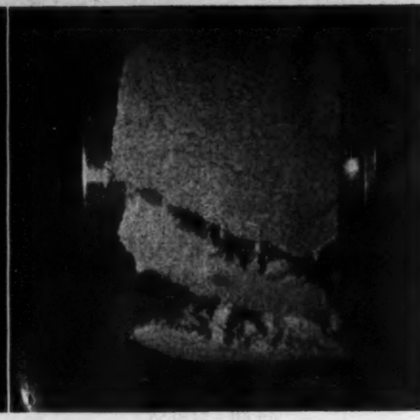
 

Fig. 6 (left)—Compression test on "green" sand bonded with one per cent ethyl-cellulose-ester (starch). Green compressive strength, 130 gm/cm² (1.85 psi). Deformation just before fracture, 10 per cent. Fig. 7 (right)—Same as Fig. 6, but at instant of failure. Deformation, 14 per cent in this instance.

Endell[6] and collaborators. Although a different physical quantity is concerned, the results are instructive from the point of view considered. Na-bentonite, more than other binders, reduces the coefficient of internal friction. A fine silica flour will serve as an example to show how the properties of binders can be influenced.

Concerning their mutual influence as to mechanical properties such as permeability and dry compressive strength, we may refer to the work of Morey and Taylor[7] and to Fig. 11. The causes of the different characters of the curves of Fig. 11 will be sought in the simultaneous presence of different clays and in the influence of water upon their swelling abilities, with the object of explaining the green compressive strength curves and especially the different positions of maximum permeability.

Thixotropy Defined

The swelling of binders, with reference to molding sands, has been studied by H. Reininger and H. Jentsch,[10] K. Endell and collaborators,[9] and Piper.[11] The swelling mechanism cannot be regarded as the principal cause of the binding properties of materials found with or admixed with molding sands. This is indicated by the circumstance that any principal difference does not exist in the manner of admixing the binder, as is shown in Fig. 12 for the addition of Na-bentonite and water to sand.

Thixotropy is most frequently defined as the process describing the ability of a colloidal gel to change, upon shaking or mixing, into a relatively mobile mass, which reverts slowly to the gel condition when in a state of rest. Thixotropy is an especially clear illustration of structural viscosity, because small shear stresses will be found to have no effect upon the gel, but in the case of high shear stresses (e.g., those produced by shaking) the gel is transformed into a liquid.

According to Winkler[12] thixotropy is well defined as the proportion of the volumes of liquid and solid matter which is required, one minute after shaking, for the suspension to just flow out of an 8 mm diameter test tube when the test tube is changed from a vertical to a horizontal position.

U. Hofmann[13] has conceived a model which is useful in explaining thixotropy of Na-bentonite. Hofmann imagines that under certain circumstances the layers of Na-bentonite in water are arranged as a house built of cards. Thixotropy, therefore, attains its maximum value when the particles of Na-bentonite, without losing contact with one another, occupy the greatest possible volume.

Figure 13 shows the influence of various conditions of mixing Na-bentonite with sand upon the value of thixotropy, measured according to the method of Winkler. It will be clearly seen that mechanical action such as mixing Na-bentonite with sand in the presence of water produces favorable results due to the swelling and distribution of the binder.

Thixotropy has also been measured for the same mixture for various orders of admixing the ingredients. Thixotropy changes with the resulting space distribution of Na-bentonite and parallels the course of green compressive strength. At the same time it can be demonstrated that thixotropy indicates sensitively the quality of Na-bentonite, and that it can serve in practice for the evaluation of various deliveries.

Thixotropy can exert considerable influence upon the green compressive strength because of the dependence of this strength upon the time factor. In the case of Na-bentonite, green compressive strength measured immediately after mixing can be one-third less than it will be some hours later.

Fig. 8 (left)—Compression test on "green" sand bonded with 5 per cent Na-bentonite. Green compressive strength, 260 gm/cm² (3.7 psi). Deformation just before fracture, 0.0 per cent. Fig. 9 (right)—Same as Fig. 8, but at instant of failure. Deformation is 18 per cent.

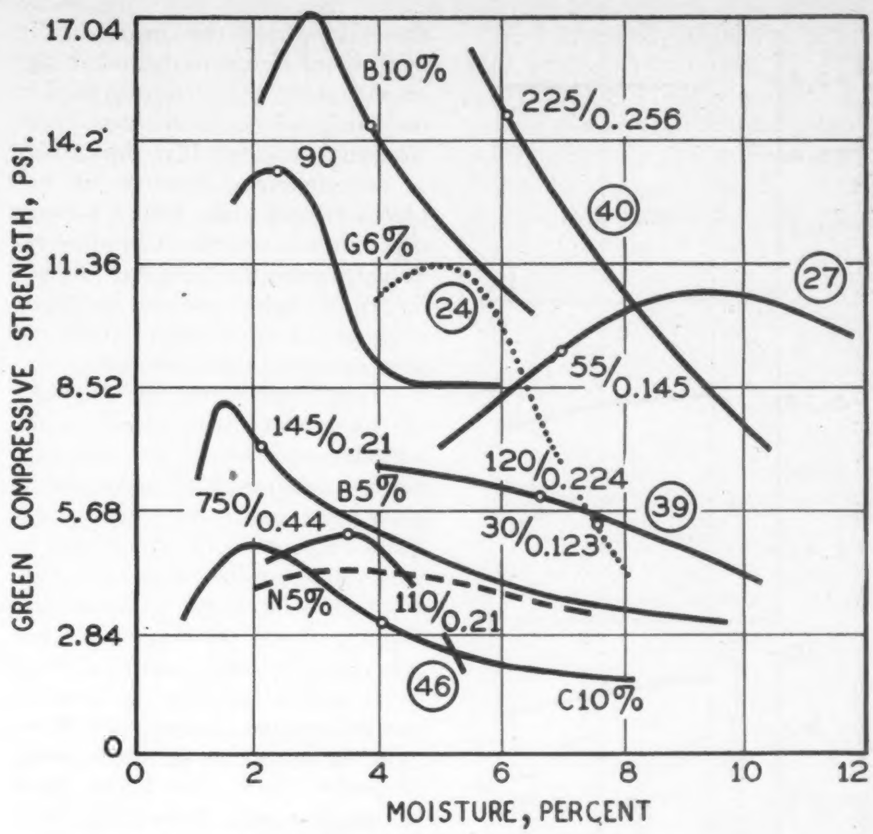
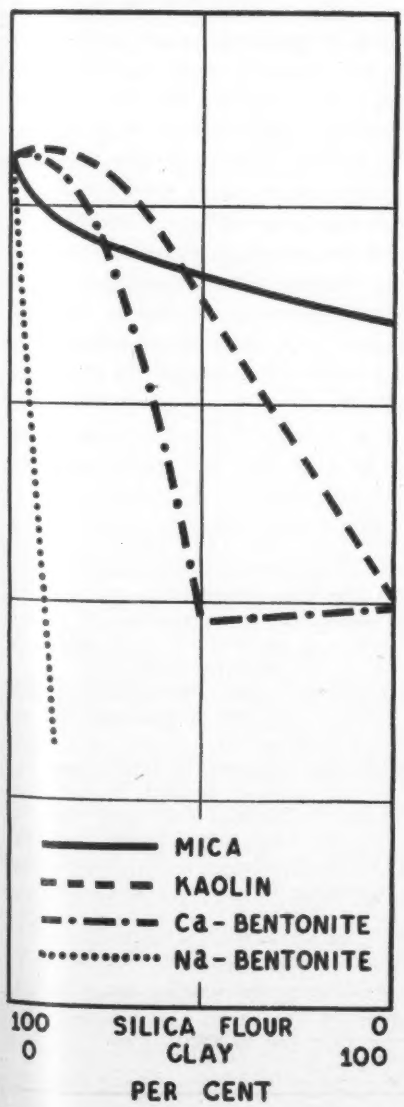


Fig. 11 (right)—Green compressive strengths of different sands and the point of maximum permeability: Curve B—Na-bentonite according to Morey and Taylor;[7] Curve C—clay according to Morey and Taylor;[7] Curve G—activated Na-bentonite from Geisenheim according to Endell;[9] Curve N—current-activated German Na-bentonite. Clay contents of Czechoslovakian naturally bonded sands according to Pisek and Holman,[8] in percentages: Curve 24—Rudice, 15.9; Curve 27—Stepanov, 14.5; Curve 39—Blansko, 10.6; Curve 40—Rosice, 14.1; Curve 46—Kobylisy, 9.2. NOTE: In a designation such as 90/0.145 the first number gives the point of maximum permeability; the second number the average grain size for the sand used.

Fig. 10 (below)—Relation of different clays admixed with silica flour, and coefficient of internal friction.



In conducting such tests all outside influences such as drying-out must be eliminated.

Some macromolecular organic materials behave similarly. These materials are always sensitive, in varying degrees, to the time of mixing, because their molecules can be destroyed by the grinding effect of sand grains. This can be demonstrated experimentally by centrifuging a suspension of such substances through a layer of sand, resulting in a decrease of viscosity although the composition remains the same.

Strength After Drying. The term "drying" has different physical, chemical and mechanical interpretations with respect to the particular binder being considered. It is necessary to distinguish between the processes by which a binder develops its strength after drying. The processes are: (1) Simple mechanical desiccation during which the binder does not change chemically; (2) chemical change in the binder; (3) physical change marked by loss or binding of water.

In the first case capillary pore water is always removed, and it does not matter if this is done in vacuum at room temperature or by the application of temperatures up to the boiling point of water at normal barometric pressures, this latter method being the only practical way. All clays and some water-organic binders are dried in this manner.

In the second case the binder changes chemically, the action being accelerated by the application of temperatures above that of the boiling point of water. A classical example is the polymerization of linseed oil. Under the influence of varying higher temperatures different reactions of the binder will take place.

For example, the condensation product of sulphite lyes with formaldehyde and urea can be completed during the drying according to curve A, Fig. 14. The influence of higher temperatures upon the "dry" transverse strength after a 2-hr drying period is indicated by curve B of Fig. 14, for the precondensed products of sulphite lyes with formaldehyde and urea.

The third process of drying involves (1) the loss of water of crystallization accomplished above the boiling point of water, e.g., in clays, and (2) the binding of water (hydration) to the binder particles, e.g., portland cement.

When chemical reaction is necessary to produce dry strength the drying requires two phases. During

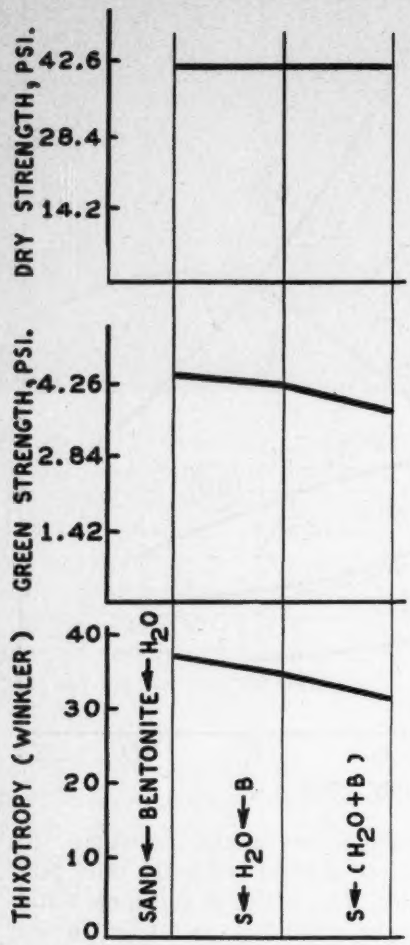


Fig. 12—Influence of the order of admixing Na-bentonite and water on the strength properties of sand.

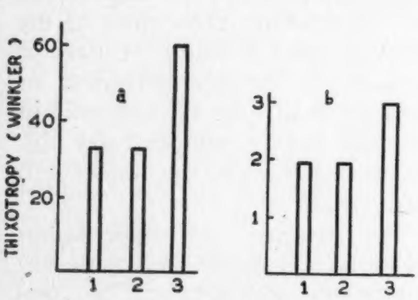


Fig. 13—Values of thixotropy (according to Winkler) for sand and Na-bentonite mixtures: (a) Ratio of volumes of water to one unit volume of Na-bentonite, and (b) ratio of volumes of water to volumes of sand plus Na-bentonite. Column 1—Sand and 5 per cent Na-bentonite as "dry" materials hand-mixed for 20 min.; Column 2—same proportion of materials mixed "dry" for 20 min. in a muller-type mixer; Column 3—five per cent water added and "wet" mixed for 20 min. For the third condition, thixotropy was determined after the addition of 33 volumes of water, agitating, and then a setting period of 15 hr.

the first phase the mechanically held water is removed, and in the second phase the chemical reaction occurring results in an increase in strength, provided that the binder is not destroyed because of too high a temperature. Figure 4 shows the difference between binders requiring only the removal of mechanically held moisture and those requiring a chemical reaction for development of dry strengths.

Upon desiccation the particles of the binder are enabled to approach one another, and the previously mentioned attractive forces grow more effective than when water is present. The manner in which the binder particles *cohere* at their surfaces and *adhere* to the surface of the sand grains is important. Research upon various kinds of bentonite by the electron microscope has shown that Wyoming bentonite is probably more adaptable since after being dried it forms a more cohesive skeleton.

Organic Binders

When more water than that required to produce the optimum green compressive strength is admixed, the dry compressive strength will be found to increase. This is common to all organic binders and is caused by better distribution of the elementary particles. Viscosity and physical-chemical surface effects must be considered for organic binders.

For example, on experiment with an asphalt emulsion (35 per cent asphalt, 8 per cent Tall oil, 3 per cent NaOH 38Bé and remainder water) has shown that the emulsion is completely separated into constituents upon contact with pure silica sand and the dry transverse strength is zero. This behavior follows experience with highway-emulsions of oil-in-water type, for distribution in pure silica sand is much worse than distribution in crushed stone which is produced from minerals containing compounds of bivalent and trivalent metals.

It has been possible to stabilize the tested emulsion partly by (1) admixing 5 per cent Na-bentonite which results in a dry transverse strength of 4.5 kg/cm², or completely by (2) immersing the sand in a 0.5 per cent soap solution which results in a dry transverse strength of 8 kg/cm². Foundries generally use emulsions of the water-in-oil type, and the previously mentioned separation into constituents does not occur with this type of emulsion.

Of all the factors involved in the attainment of dry strength, viscosity is the most evident, and one general statement pertaining to this production of dry strength by organic binders is as follows: When the viscosity exceeds a certain upper limit, depending upon the binder and mechanical mixing equipment, the dry strength continues to decrease at constant amounts of binder. This is well shown in Fig. 14c in the case of sodium-glycolate of cellulose, and in Fig. 15 for the condensate of sulphite lye.

For the example cited in Fig. 15, the optimum values of dry transverse strength can be achieved for each amount of binder at a constant proportion of total water in the mixture and binder. This relation is given by the proportionality factor w/b.* For the example cited, $w/b = 0.4$ and the binder itself had a water content.

If the green compressive strength and the dry transverse strength of any binder were dependent solely upon viscosity, it would be expected that for various amounts of the binder the maximum strengths would be obtained at constant value of w/b. This has been found to be true for the green compressive strength.

With some small deviations the

* The proportionality factor w/b can be considered in various ways.

Let w = amount of water added to mixture in per cent.

Let b = amount of binder "as supplied" by producer, in per cent.

Let b' = amount of binder less any water content, in per cent.

Let w' = amount of water in "as supplied" binder, in per cent.

Therefore $b' + W' = b$

$$\text{or } \frac{w}{b' + w'} = w/b$$

Another proportionality factor such as $\frac{w + w'}{b'}$ can be used.

factor w/b is 0.26 for the data reported by Morey and Taylor [7] who studied the properties of Na-bentonite bonded mixtures. From the dry compressive strength data of Morey and Taylor, w/b was calculated as 0.54 when the relationship of some certain per cent of binder with water ceases to be linear. If we desire an exact expression for w/b, it is always well to note the strength and permeability values at definite amounts of binder or water in relation to the factor w/b.

Relationships which otherwise would be expressed by a three-dimensional diagram are thus quite easy to comprehend. In practice it is not feasible to compare several three-dimensional diagrams, which would be necessary when one is obliged to seek a compromise percentage of water sufficient for dry transverse strength but not too high for ample green compressive strength. The comparison of two-dimensional diagrams (simple coordinate systems) giving the relation for the factor w/b is quite simple.

From these two-dimensional diagrams it is evident that for a given amount of binder the value of the factor w/b is always much lower and the viscosity higher after obtaining the maximum green compressive strength in comparison with a lower viscosity and higher value of the factor w/b after obtaining the maximum dry transverse strength.

Strength Values

Frequently, the latter strength value cannot be attained because in the "green" condition the sand flows. As a result we are primarily concerned with the increase of internal friction within the binder for the production of green compressive strength. The binder must be uniformly distributed between the grains. On the other hand, to achieve the highest possible dry transverse strength the grains must be perfectly enveloped, for only then can the binder achieve a strong continuous binding of the grains.

Simultaneous Use of Various Binders. The simultaneous admixing of two or more binders provides properties not attainable from the use of a single binder. Most frequently, practice in Czechoslovakia has found it necessary to increase the strength properties in the "green" state of core mixtures bonded by organic materials such as oils (which produce high strength properties upon drying).

Mere experience leads most frequently to quite negative results, proven by the example given in Fig. 16, where an emulsion oil (water-in-oil) has been literally spoiled by admixing a naturally bonded sand. Figure 17 indicates that much better results can be obtained by the simultaneous use of Na-bentonite with sulphite lyes, or even better, condensation products derived from them. Such mixtures have given satisfactory results for the production of blown cores. The use of Na-bentonite with a cereal binder such as corn flour belongs in this class.

In all cases of the simultaneous use of a clay and a water-dispersed organic binder, the clay is the decisive factor for green compressive strength. The eventual increase in green compressive strength upon the addition of an organic binder is fictitious, for the organic binder absorbs a part of the water. The reduced amount of water available to the Na-bentonite produces a higher green compressive strength.

In all cases of simultaneous use of a clay and a water-dispersed organic binder, the dry strength properties are always higher than when the clay is used alone, and generally lower than when the organic binder is used alone. Water-soluble organic binders are influenced less by the presence of clays than water-dispersed organic binders. Other properties such as reduced drying on the molded surface or change of strength at high temperatures, as well as "green" properties, are involved in the simultaneous use of inorganic and organic binders.

Rather widespread use of cement-sand mixtures has led to experiments with various combinations which should have offered a mixture of certain green compressive strength needed for the production of cores. For this purpose water-dispersed starch or ethylester of cellulose have been used. They should have influenced the factor w/b of the cement-water system.

At first the strongly swelling substance should deprive the cement of water. During the setting of the cement the organic binder should permit the return of the water

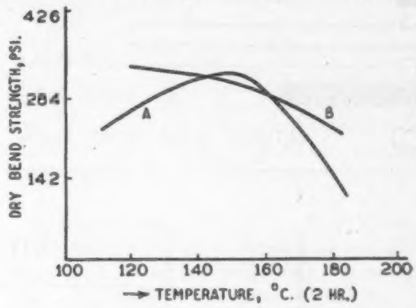


Fig. 14—Relation of the condensation degee of the sulphite lye binder to the dry transverse strength.

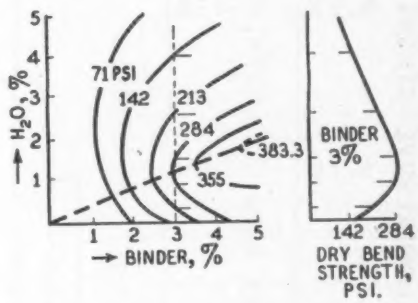


Fig. 15—Dry transverse strength of condensated sulphite lye binder with various percentages of water.

necessary for the hydration of the cement. Na-bentonite, or even the admixture of a naturally bonded sand has been used with some success, but at a reduction in the final strength of the cores.

None of these methods is a final solution, and we can but hope that the results of the theoretical study of binders in the indicated directions will bring improvements, either with an organic binder offering at the same time green and dry strengths, low gas content, and suitable strength at higher temperatures, or by a combination of binders influencing one another in a positive sense.

Elevated Temperature Sand

Up to the present, little attention has been given in Europe to the strength of sand mixtures at elevated temperatures. The study of the influence of elevated temperatures has been limited to observation tests.

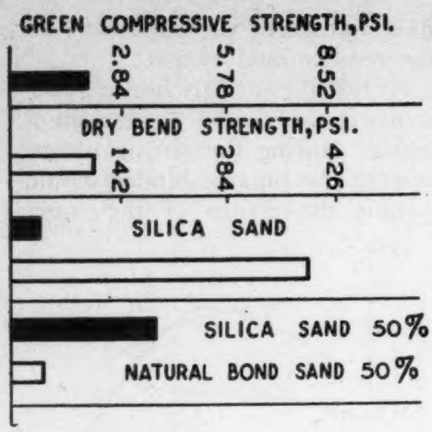
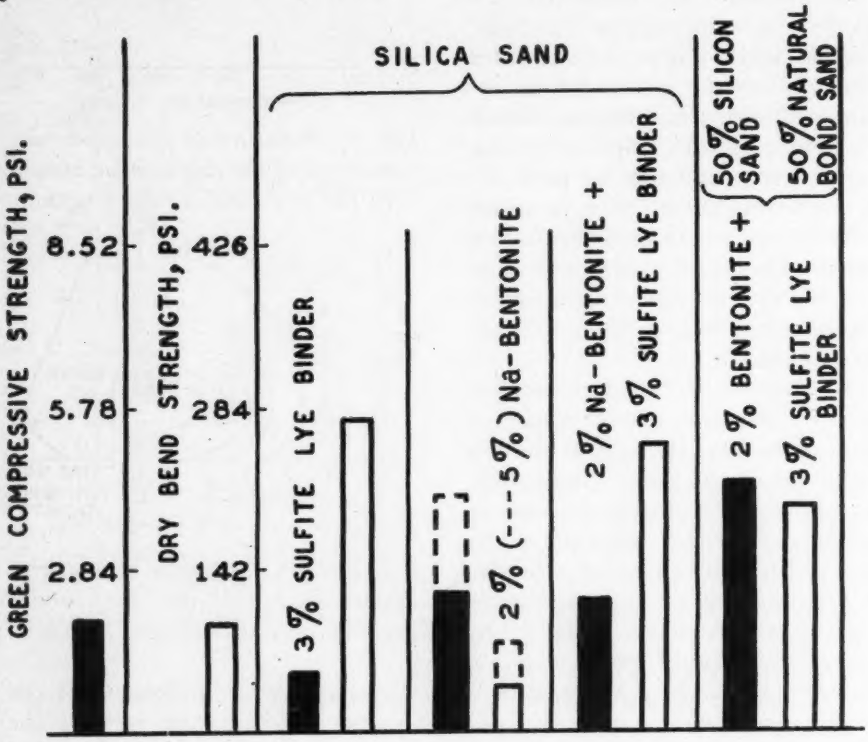


Fig. 16—Relation between simultaneous addition of emulsion oil (oil in water) and naturally bonded sand to silica sand with respect to developed green compressive strength and dry transverse strength.

Fig. 17 (below)—Relation between simultaneous addition of Na-bentonite and condensated sulphite lye binder to silica sand with respect to developed green compressive strength and dry transverse strength.



These tests lead to the knowledge that sands bonded by clays increase in strength properties up to a certain temperature at which no liquid phase occurs. The causes of this phenomenon should be determined with regard to the extent of crystalline transformations, to reactions in the solid state, and to the tighter binding of the exchange cations which on warming lose their exchange ability.

Much attention has been given to the behavior of sand mixtures at temperatures approaching the melting points of iron and steel. Ardenne and Endell[14] especially have studied, under the electron microscope, bonding materials at fusion temperatures and the following conclusions have been drawn: The fusion temperature of binders which form a continuous peel of sand facilitating cleaning is relatively low. Up to the present the only experiment regarding the viscosity of the bonding material of a naturally bonded sand, from the Rosenthal district, has been conducted in the temperature range 1200-1450 C (2192-2642 F).

According to Endell,[15] viscosity at elevated temperatures can be calculated from chemical composition. The results for certain available sands are interesting, although not reliable at this time. However, these results do support Endell's conclusion regarding the calculation of viscosity, and this field of investigation deserves more attention because it may lead to improvements in molding sand.

The description of experimental details has been limited as much as possible. The methods used to determine the strength properties do not differ essentially from the Standard A.F.A. procedures.[16] The A.F.A. procedures are by far the most frequently used in Europe, although objections have been raised regarding the method of ramming the test specimens.

It must be admitted that to some extent these objections are justified, especially by those foundries that desire to study more thoroughly the mechanism of bonding. It is evident that this subject deserves to be examined and discussed.

In addition to his own results and experiences, the author quotes those of other investigators to indicate European trends of investigation during the long war period.

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FIRM FACTS

Facilities of **Standard Foundry, Inc.**, Cadillac, Mich., were severely damaged by a recent fire. The plant is in limited production while under repair.

Controlling interest in **Titan Metal Mfg. Co.**, Bellefonte, Pa., has been purchased by **Consolidated Coppermines Corp.**, which had previously been engaged solely in mining copper-bearing ore from its Kimberly, Nev., properties.

Mattison Machine Works, Rockford, Ill., has begun construction of a new modern foundry to replace the building destroyed by fire recently. The new plant will be of masonry and fabricated steel and will incorporate the latest design features.

New management has taken over **French Foundry Co.**, Bay City, Mich., which has specialized in iron, brass, aluminum and copper work for the past 20 years. The plant is now being operated as **CPR Foundry** by F. E. Reeves of Saginaw, Mich., and formerly superintendent, Saginaw Malleable Iron Div., General Motors Corp., Saginaw. W. B. Pryer and L. F. Corp, both of the Malleable organization, are associated in the purchase, although not active in the firm's operations.

Fergus Foundry Co., Fergus Falls, Minn., is preparing to resume operations at its foundry, which was almost completely destroyed by fire some months ago and has since been rebuilt.

Bates Expanded Steel Corp., East Chicago, Ind., announces purchase of 16 acres of industrial land at Torrance, Calif., from **Pacific Electric Railway Co.**

Broken Arrow Castings Co., Broken Arrow, Okla., has poured the first gray iron castings ever produced in that community, for John Zink, burner manufacturer, Tulsa, Okla. The new foundry plant is owned and directed by C. Lawmaster and Lee Miller.

Griswold Mfg. Co., Erie, Pa., recently purchased by an eastern group, will continue operations under the same firm name. Officers of the reorganized firm are: I. Tachna, president; J. M. Schaap and J. Arronson, vice-presidents; S. S. Flug, secretary; A. S. Weissman, treasurer.

Oranco Mfg. Co. has been incorporated at Anaheim, Calif., and is expected to be in production by mid-April. Buildings are under construction at 125 W. Commercial St.

All officers and directors of the new firm are associated with **Westlectric Castings, Inc., Los Angeles**. S. Gee Lowe, president of the Westlectric firm, is president at Oranco, where B. D. Lowe is vice-president; J. H. Lane, secretary, and G. M. Lowe, treasurer. Directors include Alex Ross, E. Linsenbard and W. D. Bailey, Jr.

General Electric Co., Schenectady, N. Y., will operate the new **Knolls Atomic Power Laboratory** for the government. Construction will begin shortly in Nis-Kayuna, near Schenectady. General Electric already has under construction a new research laboratory on the same property, and the work of the two laboratories will mesh closely. Both will be under the direction of Dr. C. G. Suits, vice-president of General Electric and director of the research laboratory. The Knolls facilities will be used for research on atomic power development.

Caterpillar Tractor Co., Peoria, Ill., has established a new two-year sheet metal training course to develop applicants in many phases of structural and sheet metal fabrication. **W. M. Owen**, assistant director of training for the firm, has announced. Both practical shop training and extensive classroom instruction will be given.

American Light Alloys, Inc., 1265 McBride Ave., Little Falls, N. J., a new nonferrous foundry firm specializing in aluminum and magnesium sand castings, has been organized by William Wilson, Jr., formerly superintendent of foundries, **Eclipse-Pioneer Div., Bendix Aviation Corp.**, Teterboro, N. J., who is president of the new company.

Hydropress, Inc., 570 Lexington Ave., New York, exhibited its standard "Hyrdocast" die casting machine at the Magnesium Exhibit sponsored jointly by the Magnesium Association and the Air Material Command, Army Air Forces, at Wright Field, Dayton, Ohio, February 18-20. The demonstration of magnesium die casting was described as the first ever made. Metal for the cold chamber, semi-automatic machine of 40,000-lb injection pressure, 300,000-lb clamping pressure, was melted and kept in an electric furnace, adjusted to avoid oxidization.

Frank Foundries Corp., Moline, Ill., has purchased a block of lots there and plans to construct a new manufacturing building. The firm also announced purchase of the railroad passenger depot at Moline, which it has leased since 1933.

Keuthan Foundry Co., Middletown, Ohio, has been sold to **Black-Clawson Co.**, Hamilton, Ohio. No personnel changes in the organization are contemplated.

Sealed Power Corp., Muskegon, Mich., has announced a three-million-dollar expansion program, featuring the construction of a new foundry at Rochester, Ind., and enlargement of plant facilities at St. Johns, Mich.

All-State Welding Alloys Co., Inc., recently announced the opening of an export office at 21 State St., New York, with J. V. Cremonin as manager.

Westinghouse Electric Corp., Pittsburgh, Pa., has announced arrangements to take over operation of the Sunnyvale, Calif., plant of **Joshua Hendy Iron Works** under a ten-year lease with option to purchase. The facilities will be under the direction of H. F. Boe, vice-president in charge of the Westinghouse manufacturing and repair division. Activities of the Hendy firm at Torrance, Calif., and Ampero, N. J., are not affected.

Seven technical films from the motion picture library of **Allegheny Ludlum Steel Corp.**, Oliver Bldg., Pittsburgh, Pa., have been announced as available for free showings. Titles are: "Melting of Huron Die Steel," "Stainless Steel," "Corrosion," "Exploring with the Microtimer," "Steel for the Ages," "The Manufacture of Dies" and "Arc Welding Stainless Steel."

Spectators watching die casting machine operate at Magnesium Exhibit, Wright field, Dayton, Ohio. Exhibit described as first of its kind to be made.

HOLD FIRST

ALL-CANADIAN CONFERENCE

Foundrymen Who Attended Combined Meeting Newfoundland-Ontario and E. Canada Chapters Rewarded With Interesting Program.

THE FIRST ALL-CANADIAN Conference of the A.F.A. Eastern Canada and Newfoundland and Ontario chapters was held in Toronto, February 28-March 1. Over 300 members attended the two-day meeting and the turn out for the technical sessions set a new record.

Jock Wotherspoon, Imperial Iron Corp., Ltd., St. Catharines, Ont., Chairman, Ontario chapter, was taken ill shortly before the conference opened, but the success of the meeting was already assured by the splendid work he and other committee members had done in preparing for the event.

His Worship, Mayor Robert Saunders of Toronto, welcomed the members. In responding, National President Sheldon V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, congratulated the Canadian chapter members on the progressive nature of their activities. Pointing out that the foundry industry is basic the world over, he said every modern industry is coupled in some way with it.

Discusses Labor Relations

The principal banquet speaker was Professor James C. Cameron, instructor of industrial relations, Queen's University, Kingston, Ont., and his subject "Recent Trends in Industrial Relations."

Mr. Cameron said: "The war and the post-war period have set loose a new flood of human energy in the direction of more control by labor over its own life in industry."

"This being the plain fact," he continued, "it becomes imperative for employers to realize that beneath the movement for control lies a truly enormous force—a force that has already deprived management of many of its traditional rights and prerogatives, greatly limited the authority of management, and impinged on management functions at many points."

Wm. W. Maloney, Secretary of the A.F.A., speaking on "Progress of A.F.A." at a luncheon session, pointed out that the organization has been in existence for over fifty years and that the ideals behind the founding of the group in 1897 remain as the primary objects of the Association today. Membership stands at 9,000 and is steadily growing, he declared. The work of the one hundred technical committees is outstanding, covering a wide range of foundry problems, he added.

Before the steel group, Turney Shute, assistant foundry foreman, Canadian Car & Foundry Co., Ltd., Montreal, spoke on "Internal Risers for Steel Castings." He said: "The subject of gates and risers always provides interesting ground for discussion, because it is a technique which has never yet been tied to a fixed set of rules for universal application, and we are always hearing of some new development to change our ideas from day to day. Among the recent innovations has been the use of central or internal risers on certain designs, and in various foundries with such good results from the aspect of costs as well as quality, that this innovation might now be justifiably classified as a new addition to the technique of applying gates and risers. From the practical point of view it simply takes

Smiles all around; first All Canadian A.F.A. Conference a success. Left to right: Henry Louette, Chairman, E. Canada-Newfoundland chapter; A. E. Cartwright, Vice-Chairman, E. Canada-Newfoundland chapter; S. V. Wood, president, A.F.A.; J. Dalby, Vice-Chairman, Ontario chapter; William W. Maloney, secretary, American Foundrymen's Association.

Professor J. C. Cameron, Queen's University, speaker on "Industrial Relations" at the banquet.

advantage of certain facts with which we have been long familiar."

James G. Dick, B.Sc., chief chemist and metallurgist, Canadian Bronze Co., Ltd., addressed the non-ferrous group, his subject being "Metallurgy in the Foundry." In his opening remarks, Mr. Dick said: "I am quite aware that the technical man, whether metallurgist or chemist, appears to be more or less of a nuisance to the average foundryman. He persistently waves pyrometers and other gadgets of his profession in front of the foundryman, especially when he is preoccupied with something else. He takes what appear to be perfectly good castings, and breaks them up to see what they are like inside, thereby decreasing the production. He is behind the hand that delves into the molder's or coremaker's sand pile, taking samples of it and later returning to bother him about the moisture content or some other physical content. I am also aware that the molders and coremakers are the basic producers in the foundry but, after all, gentlemen, the technical man has to make a living too, and, apart from his apparent nuisance value, he can be of considerable use to the foundry operation."

Casting Defined

J. W. Meier, metallurgist, Minerals Dressing and Metallurgy Division, Dept. of Mines and Resources, Ottawa, Ont., in a non-ferrous discussion on "The Founding of Light Alloys," said, "Casting of any metal is still an art rather than a scientifically controlled technical process, and is based mainly on practical experience. Although this is true also in the field of light alloys, the unique career of the youngest additions to the non-ferrous metal group was made possible mainly by fundamental and industrial research on their structure and properties, as well as of special fabrication and designing techniques adapted to their working characteristics. This is certainly the reason why we know perhaps more about the metallurgy and proper melting and refining techniques in light alloys, especially in aluminum, than in the case of many long established copper alloys or even grey iron, where the high quality necessary for many light alloys application is not needed."

At the open forum on steel foundry problems, Dan Hassel, west side superintendent, Dominion Foundries & Steel Co., Ltd., gave an outline of basic steel melting practice for carbon and low alloy steels, emphasizing the more controversial points encountered during his long experience. The use of exothermic silicon for final deoxidation results in increased fluidity at lower temperatures according to his observation. The use of silico-manganese deoxidants is beneficial in giving better non-metallics grouping and lower count. Centre-line shrinkage is partially controllable through more exact correlation of tapping temperature, holding time in the ladle, and standardization of ladle temperatures when they leave the preheater. These and many other details provoked a lively discussion.

Sand and Molding Problems

Neil Kennedy, foundry superintendent, Wm. Kennedy & Sons, Ltd., followed with a resume of his experiences on practical sand and molding problems in the steel foundry. A brief history was given of the development of steel sand practice from the old days when a coarse one or two-screen sand plus silica flour was used, through the period when the use of bentonite bonds forced the use of the finer, more evenly distributed sands, to the present stage of sands having

(Continued on Page 196)

Good speeches were the rule at the All Canadian Conference. Listening intently (left to right, below) were S. V. Wood, President, A.F.A.; J. A. McFadyen, Past Chairman, Ontario chapter; Joseph Sully, National Director; W. J. Brown, Director, E. Canada-Newfoundland chapter; W. W. Maloney, Secretary, A.F.A., and A. E. Cartwright, Vice-Chairman, Eastern Canada and Newfoundland chapter.

Adopt Program For

EDUCATIONAL FOUNDATION

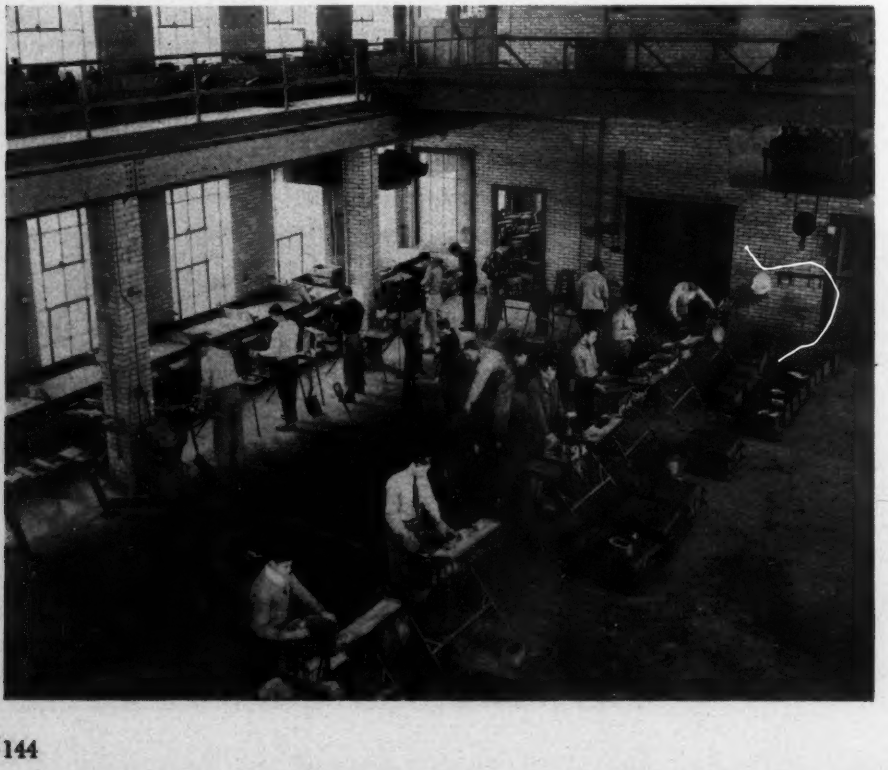
Industry Support Sought for Foundry Training Courses in Five Universities; Plan Scholarships

THE FERROUS FOUNDRY educational and scholarship program advanced one step nearer to realization, early in March, when the Foundry Educational Foundation was incorporated and plans were announced for financing the long-term project.

This is the program initiated jointly by the Gray Iron Founders' Society and the Malleable Founders' Society, with the cooperation of the American Foundrymen's Association, to encourage engineering schools to offer special foundry courses and to encourage young men to enroll for this type of training, preliminary to seeking a career in the foundry industry.

The Foundation proposes, in its first year, to provide forty scholarships to deserving youths selected by five nationally recognized universities. Eventually the number of scholarships to be made available is expected to total 125. Engineering schools co-operating in the program are Massachusetts Institute of Technology, Cambridge, Mass.; Cornell University, Ithaca, N. Y.; Case School of Applied Science, Cleveland; The University of Cincinnati, Cincinnati, and the University of Wisconsin, Madison.

Students at work in the modern, well equipped foundry at the University of Wisconsin, Madison. The Foundry Educational Foundation will encourage expansion of this type instruction in program shaped to awaken youthful interest.



These schools will either institute or further develop elective courses (in junior or senior years) on foundry technology and foundry metallurgy. Each will be full-year courses combining technical work with practical laboratory experience. The courses will be developed by the universities, but each institution will be accorded counsel by the members of a technical committee from the foundry industry.

The five co-operating schools will provide a good basic engineering education as well as courses dealing with the theory and development of modern ferrous foundry processes. Instruction in metallurgy, economics, accounting, time and motion study, industrial management and personnel relations will be included. Students will study the handling of mold materials, and the flow and solidification of molten metal and gases in metals as related to the production of sound castings. New methods of molding, melting, gating, risering, and cleaning will be covered.

In return for establishing these courses and co-operating with the Foundry Educational Foundation each university will be accorded financial support for the purchase of foundry equipment, as well as assurance through scholarships of an adequate number of qualified students to justify the classes and additional instruction facilities, if they are required.

The governing body of the new Foundry Educational Foundation will have eleven directors, two each of whom will be chosen by the three

(*Continued on Page 174*)

★ NEW A. F. A. MEMBERS ★

February 15 to March 15—During this period of time 29 chapters contributed 193 new members and one conversion to the Association's records. The largest increase is reported by Birmingham, 23; undoubtedly due to its recent regional conference. Rocky Mountain Empire chapter continued its rapid growth with 16 while two of the Association's oldest chapters, Chicago and Northeastern Ohio, added 14 new members.

Conversion—Personal to Company

*Ward Bros. Foundry Co., Horseheads, N. Y. (J. P. Ward, Pres.)

BIRMINGHAM DISTRICT CHAPTER

Clarence Bailey, Floor Frm., McWane Cast Iron Pipe Co., Birmingham, Ala.
R. M. Blakely, Secy-Treas., Anniston Soil Pipe Co., Anniston, Ala.
Robert B. Carr, Jr., Production Manager, Lee Brothers Foundry, Anniston, Ala.
L. C. Cobb, Frm., American Cast Iron Pipe Co., Birmingham, Ala.
S. H. Dean, Supt., Emory Pipe & Foundry Co., Anniston, Ala.
Ray A. Dyke, Jr., Phys. Testing, American Cast Iron Pipe Co., Birmingham, Ala.
Ernest C. Finch, American Cast Iron Pipe Co., Birmingham, Ala.
Earl Griffin, Purchasing Agent & Gen. Mgr., Pate Supply Co., Birmingham, Ala.
W. W. Hazzard, Jr., District Manager, Kerchner, Marshall & Co., Pittsburgh, Pa.
J. Arthur Hill Foundry Supt., Goslin-Birmingham Mfg. Co., Inc., Birmingham, Ala.
Clarence E. Holmes, Manufacturers Agent, Watts Bldg., Birmingham, Ala.
R. W. Keiser, R. W. Keiser & Co., Atlanta, Ga.
J. W. King, Secy-Treas., Rudisill Foundry Co., Anniston, Ala
W H. Lanier, Auditor, Anniston Soil Pipe Co., Anniston, Ala.
Fred J. Macready, American Cast Iron Pipe Co., Birmingham, Ala.
A. R. Marcus, Floor Frm., McWane Cast Iron Pipe Co., Birmingham, Ala.
J. A. Morgan, Cashier, Emory Pipe & Foundry Co., Anniston, Ala.
Carter N. Paden, Vice Pres.-Gen. Mgr., Maccarin Bushing Co., Chattanooga, Tenn.
Frank M. Robbins, Jr., Robbins & Bahr, Chattanooga, Tenn.
E. N. Rooks, Supt., Rudisill Foundry Co., Anniston, Ala.
*Rudisill Foundry Co., Anniston, Ala. (Frank T. Hamilton, Pres.)
Hughey S. White, Production Mgr., Anniston Soil Pipe Co., Anniston, Ala.
B. W. Worthington, Dev. Engr., McWane Cast Iron Pipe Co., Birmingham, Ala.

CANTON DISTRICT CHAPTER

Michael Wolf, Brass Fdry. Supvr., Pitcairn Co., Barberton, Ohio.

CENTRAL INDIANA CHAPTER

J. W. Dunn, Fcty Mgr., Rockwood Mfg. Co., Indianapolis.
Marion E. Loudenback, Fdry. Supt., Frank Foundries Corp., Muncie.
Charles Myers, Fdry. Frm., Rockwood Mfg. Co., Indianapolis.
Walter E. Palmer, Supt., Rockwood Mfg. Co., Indianapolis.
Geo. J. Sutton, Asst. Fdry. Frm., Rockwood Mfg. Co., Indianapolis.

CENTRAL NEW YORK CHAPTER

*Caldwell & Ward Brass Co., Syracuse. (J. D. Rogers, Pres.)
Robert William Cologgi, Fdry. Engr., Goulds Pumps, Inc., Seneca Falls.
Clyde R. Swartz, Owner, Binghamton-Pattern Works, Binghamton.
William P. Ward, Secy.-Treas., Ward Bros. Foundry, Inc., Horseheads.

CENTRAL OHIO CHAPTER

*Summer & Co., Columbus. (T. W. Payne, Asst. V.-P.)
Joseph S. Summer, V.-P., Summer & Co., Columbus.
James Whitmer Walther, Mltg. Supvr., Dayton Steel Fdry. Co., Dayton.

CHESAPEAKE CHAPTER

*Cochrane Brass Foundry, Inc., York, Pa. (Thomas B. Belfield, Pres.)
William S. Crisp, Student Met., The Gibosn & Kirk Co., Baltimore, Md.
Wm. M. Eyster, Mgr., Eyster, Weiser Co., York, Pa.
Ben Lavetan, Partner, L. Lavetan and Sons, York, Pa.
James O'Keeffe, Jr., Walker Machine & Foundry Corp., Roanoke, Va.

CHICAGO CHAPTER

*Carb-Rite Co., Chicago Heights, Ill. (J. O. Griggs, Pres.)
Kenneth R. Ford, Salesman, Federal Foundry Supply Co., Chicago.
Wallace E. Gall, Salesman, Swan Finch Oil Corp., Chicago.
Julius S. Groh, Asst. Met., Hansell Elcock Co., Chicago.
George P. Halliwell, Director of Research, H. Kramer & Co., Chicago.
John R. Jenkins, Res. Met., American Steel Foundries, East Chicago, Ind.
Marvin A. Kellermann, Owner, Kellermann Pattern & Foundry, Chicago.
Joseph E. Layton, Asst. Mgr. of Mfg., International Harvester Co., Chicago.
Henry Frank Linkawske, Melter, International Harvester Co., Chicago.
L. W. McConnell, V. P., Carb-Rite Co., Chicago Heights, Ill.
Milton Marks, Asst. Maint. Engr., Crane Co., Chicago.
Thomas E. Tracy, Manufacturers Agent, Thomas E. Tracy Co., Chicago.
Charles M. Uline, Secy-Treas., Carb-Rite Co., Chicago Heights, Ill.

* Company Member.

CINCINNATI DISTRICT CHAPTER

Richard J. Brinker, Supt., The Peerless Foundry Co., Cincinnati, Ohio.

DETROIT CHAPTER

Collins L. Carter, Pres. & Gen. Mgr., Albion Malleable Iron Co., Albion, Mich.
Erwin R Cprek, Met. Tester, Ford Motor Co., Dearborn, Mich.
*Essex Brass Corp., Detroit. (Ed. Hiller, Prod. Mgr.)
Ralph Fox, Frm., Federal Mogul Corp., Detroit.
W. C. Noble, Supt., Federal Mogul Corp., Detroit.
Edwin F. Reiter, Frm., Federal Mogul Corp., Detroit.
Warren H. Turner, Engr., Norton Co., Detroit.

EASTERN CANADA AND NEWFOUNDLAND CHAPTER

Horace Cartwright, Patternmkr., Robt. Mitchell Co., Ltd., St. Laurent, P. Q.
Edward Cooper, Lab. Attendant, Warden King, Ltd., Montreal, P. Q.
Ernest Delisle, Patternmkr., Davie Shipbldg. & Repairing Co., Ltd., Lauzon (Levis) P. Q.
Henry Malenfant, Office Clk. (Brass Fdry.), Crane Ltd., Montreal, P. Q.
J. Hermann Ridorossi, Molder, Crane Ltd., Montreal, P. Q.
Real Saindon, Frm., Quebec Brass & Iron Foundry Co., Ltd., Levis, P. Q.

MICHIANA CHAPTER

Walter J. Martz, Owner, Columbia Casting Co., South Bend, Ind.
R. W. Wolfram, Plt. Engr., Benton Harbor Malleable Industries, Benton Harbor, Mich.

NORTHEASTERN OHIO CHAPTER

Harry C. Ahl, Jr., Met. Engr., Ohio Brass Co., Mansfield.
John Butcher, Pouring Frm., Forest City Foundries Co., Cleveland.
Mike Butcher, Supt., Forest City Foundries Co., Cleveland.
Geo. J. Gedeon, Patt. Supt., Aluminum Co. of America, Cleveland.
Henry H. Gutzman, Partner, Forest City Pattern Works, Cleveland.
Gene Hagemier, Frm., Forest City Foundries Co., Cleveland.
Frank J. Hrabak, Owner, East End Pattern Works, Cleveland.
John Mack, Collinwood Pattern Works, Cleveland.
Charles G. Murphy, Fdry. Engr., National Tube Co., Loraine.
Edw. W. Pierie, Frm., The Motor Patterns Co., Cleveland.
William H. Redhead, Purch. Agent, Lake City Malleable Co., Cleveland.
William Stueve, Cleveland Trade School, Cleveland.
Anthony S. Sutowski, Instructor, Cleveland Trade School, Cleveland.
Clyde J. Thompson, Refr. Engr., Robinson Clay Product Co., Akron.

NORTHERN CALIFORNIA CHAPTER

*Bay Shore Foundry Co., Inc., Oakland. (Aldo F. Ricett, Pres.)
Vincent Bondi, Exec. V.-P., Bay Shore Foundry Co., Inc., Oakland.
Robert A. Johnston, Met. Dept., General Metals Corp., Oakland.
William S. Laidley, Spl. Apprentice, Vulcan Iron Foundry, Oakland.
J. D. Ramaley, Salesman, Aluminum Co. of America, San Francisco.
O. R. Showalter, Partner, Waterman Foundry Co., Exeter.
Leo M. Shriver, Supt., Waterman Foundry Co., Exeter.
*Waterman Foundry Co., Exeter. (Don Waterman, Partner)
Herrick Waterman, Partner, Waterman Foundry Co., Exeter.

NORTHERN ILLINOIS AND SOUTHERN WISCONSIN CHAPTER

Alvin Roemer, Frm., Woodmanse Mfg. Co., Freeport, Ill.

NORTHWESTERN PENNSYLVANIA CHAPTER

W. H. Piper, Ass't. Fdry. Supt., Erie Bronze Co., Erie.
Allyn S. Wright, V.-P., Reed Mfg Co, Erie

ONTARIO CHAPTER

George S Kabelin, Sales Engr., Refractories Eng. & Supplies Ltd., Hamilton, Ont.

OREGON CHAPTER

*Oregon Steel Foundry Co., Portland. (A. L. Meade, Gen. Mgr.)
H. H. Townes, Mgr., Federated Metals Div., A. S. & R. Co., Portland.
Joseph E. Vance, Salesman, Federated Metal, Div., A. S. & R. Co., Portland.

PHILADELPHIA CHAPTER

Leonard E. Bilger, Pres., Keystone Grey-Iron Foundry Co., Pottstown, Pa.
*Keystone Grey-Iron Co., Pottstown, Pa.
Howard J. Price, Supt., Keystone Grey-Iron Foundry Co., Pottstown, Pa.
H. M. Roop, Buyer, Proctor & Schwartz, Inc., Philadelphia.
Frank W. Tolan, Dodge Steel Co., Philadelphia.

QUAD CITY CHAPTER

Samuel Edelman, Inspector, Riverside Foundry, S. & W. Corp., Bettendorf, Iowa.
Harry J. Frank, Asst. Prod. Mgr., Frank Foundries Corp., Moline, Ill.
James E. Hughes, District Mgr., Precision Grinding Wheel Co., Inc., Philadelphia.
Joel W. Luck, Midwest Foundry Supply Co., Edwardsville, Ill.
Donald McDonald, Asst. Treas., Frank Foundries Corp., Moline, Ill.
D. S. Noecker, Engr., & Met., Gale Prod., Div. Outboard, Marine & Mfg Co., Galesburg, Ill.

ROCKY MOUNTAIN EMPIRE CHAPTER

R. O. Anderson, District Mgr, Norton Co., Worcester, Mass.
Jerome F. Angell, Owner, Empire Foundry Co., Denver, Colo.
Edward Dembeck, Frm., Queen City Brass Works, Denver, Colo.
Herman Feuerstein, Supt., Queen City Brass Works, Denver, Colo.
E. L. Kingry, Frm., Maclear Mfg. Co., Denver, Colo.
H. L. Mosley, Supt., The Pressure Cooker Co., Denver, Colo
W E. Norris, Pattnmkr. Frm., Chf. Insp., American Manganese Steel Div., Denver, Colo.
Mearl H. Nunn, V.-P., Winner Foundries Inc., Denver, Colo.
*Queen City Brass Works, Denver, Colo. (Edward W. Kalley, Mgr. & Partner)
David Roemer, Supt., Pattern Shop, Great Western Sugar Co., Denver, Colo.
Walter P. Rolf, Frm., Empire Foundry Co., Denver, Colo.
James E. Schmuck, Met., Rotary Steel Casting Co., Denver, Colo.
Geo. E. Tarbox, Geo. E. Tarbox Co., Denver, Colo.
M. W. Van Scoyk, Pres. Winner Foundries Inc., Denver, Colo.
Frank H. Wade, Acct., Queen City Brass Works, Denver, Colo.

SAGINAW VALLEY

R. H. Amberger, United States Graphite Co., Saginaw, Mich.
Arthur Herryman, Frm., Chevrolet Grey Iron Foundry, Saginaw, Mich.
William K. Middleton, Time-Checker, General Foundry & Mfg. Co., Flint, Mich.
Peder E. Moluf, Engr., Dow Chemical Co., Bay City, Mich.
Paul W. Olson, Asst. Pers. Dir., Fdry. Div., Eaton Mfg. Co., Vassar, Mich.
Kenneth W. Stone, Mold Dev. Engr., Albion Malleable Iron C., Albion, Mich.

ST. LOUIS CHAPTER

D. A. Gutzmann, Salesman, Midwest Foundry Supply Co., Edwardsville, Ill.
Joseph F. Underway, Dist. Sales Engr., American Wheelabrator & Equipment Corp., St. Louis.
E. L. Whitney, Sales Engr., Cortland Grinding Wheels Corp., Chester, Mass.
Lewis P. Wilson, Proc. Met., Ammunition Research, Western Cartridge Co., Alton, Ill.

SOUTHERN CALIFORNIA

Albert George Bailey, Gen. Fdry. Frm., Axelson Mfg. Co., Vernon.

TEXAS CHAPTER

Edwin P. Clarke, Dist. Rep., American Wheelabrator & Equipment Co., Mishawaka, Ind.
**San Antonio Machine & Supply Co., San Antonio. (C. C. Krueger, Pres.)

TRI-STATE CHAPTER

W. A. Breese, Coremaker & Molder, C. C. Haines Foundry, Coffeyville, Kan.
C. C. Haines, C. C. Haines Foundry, Coffeyville, Kan.
C. H. Haines, C. C. Haines Foundry, Coffeyville, Kan.
G. E. Lewis, Frm., Molder, C. C. Haines Foundry, Coffeyville, Kan.
C. W. Swift, Pattern Maker Frm., Ivan Morrow Pattern Shop & Foundry, Coffeyville, Kan.
Eugene C. Walton, Pattern Shop Supvr., Walton Foundry, Iola, Kan.
R. C. Walton, Owner, Walton Foundry, Iola, Kan.

TWIN CITY CHAPTER

Geo. C. Alm, Partner, Alm Pattern Co., Minneapolis.
John Bocan, Jr., Frm., Minneapolis Moline Power Implement Co., Minneapolis.
Wallace Fredrickson, Owner, Fredrickson Foundry Mfg. Co., Robinsdale, Minn.
Albert A. Heinrich, Fdry. Frm., Minneapolis Moline Power Implement Co., Minneapolis.
Paul L. Jensen, Sales Engineer, Despatch Oven Co., Minneapolis.
Elmer W. Johnson, Frm., Minneapolis Moline Power Implement Co., Hopkins, Minn.
Arthur Larsen, Partner, Alm Pattern Co., Minneapolis.
Oscar Malles, Molder Apprentice, Donovan Inc., Winona, Minn.
Adam Roehl, Fdry. Frm., Minneapolis Moline Power Implement Co., Minneapolis.
Olaf H. Skoglund, Core Room Frm., Minneapolis Moline Power Implement Co., Hopkins, Minn.
W. Donald Todish, Fdry. Supt., Perfection Mfg. Corp., Minneapolis.
Fred Wygal, Sandslinger Frm., Minneapolis Moline Power Implement Co., Minneapolis.

WASHINGTON CHAPTER

Leo Becraft, Fdry. Frm., Skagit Steel & Iron Works, Sedro-Woolley.
Donald R. Ferguson, Met., Terminal City Iron Works, Vancouver, B. C., Canada.
J. F. Hebert, Fdry. Supt., Skagit Steel & Iron Works, Sedro-Woolley.
E. W. Legas, Salesman, Chicago Pneumatic Tool Co., Seattle.
*Morel Foundry Corp., Seattle, Washington. (Leon Morel, Jr., Secy.)
Robert A. Pierce, Plant Supt., Tennent Steel Casting Co., Seattle.
*Skagit Steel & Iron Works, Sedro-Woolley, Wash. (S. S. McIntyre, Pres. & Gen. Mgr.)
James D. Tracy, Treas., Salmon Bay Foundry Co., Inc., Seattle.
Fred V. Wetmore, Patternmkr., Puget Sound Naval-Shipyard, Bremerton

WESTERN MICHIGAN CHAPTER

George P. Anderson, Asst. Chf. Inspector, Lakey Foundry & Machine Co., Muskegon.
Frederick Boerkoel, Salesman, Wolverine Foundry Supply Co., Grand Rapids.
Ray E. Cross, Chief Met., Michigan Light Alloys Div., Chicago Railway Equipment Co., Grand Rapids.
Francis LeRoux, Frm., LeRoux Bros. Foundry Co., Muskegon.
Fred LeRoux, LeRoux Bros. Foundry Co., Muskegon.
D. J. Vail, Campbell Wyant Cannon Foundry Co., Muskegon.

WESTERN NEW YORK CHAPTER

Harry A. Koegler, Sales Rep., General Refractories Co., Buffalo.

WISCONSIN CHAPTER

*Allis Machine & Foundry Co., West Allis. (Richard J. Patterson, Pres.)
*The Filer & Stowell Co., Milwaukee. (Frank F. Lipperer)
Harry M. Foster, Frm., International Harvester Co., Milwaukee.
Conrad J. Gould, Plant Supt., Slinger Foundry Co., Inc., Slinger.
Wm. J. Holtan, Prod. Mgr., Slinger Foundry Co., Inc, Slinger.
W. B. Jansen, Pres., Peerless Pattern Corp., Milwaukee
Julius J. Kripke, Owner, Kripke Bag & Wiper Co., Milwaukee.
Walter Puzach, Foundry Inspector, Milwaukee Gas Specialty Co., Milwaukee.
Edward P. Sheahan, Vice-President, Allis Machine & Foundry Co., West Allis.

OUTSIDE OF CHAPTER

George T. McFerren, Davenport, Iowa. (In Military Service)
Massachusetts Institute of Technology Library, Cambridge.

BELGIUM

Georges Halbart, General Sec'y., Assn. Technique de Fonderie de Belgique, Liege.

CZECHOSLOVAKIA

Alfred Augstein, Dir., Kalcium Ltd., Prague.
John Augstein, Dir., Kalcium Ltd., Prague.
Prof. Dr. Mont. Fr. Pisek, Technical High School, Bruno.

HOLLAND

AFD Documentatie, Handels Mij. R. S. Stokvis & Zonen, Rotterdam.

ITALY

Giuseppe Bagna, Mgr., AZ. Ind. Vittorio Necchi, Pavia.

SOUTH AFRICA

H. Pillman, Crown Mines, Brown Industrial Township, Johannesburg.

SWEDEN

Scania Vabis A/B, Sodertalje.

* Company Member
** Sustaining Member

FUTURE CONVENTIONS AND EXHIBITS

American Institute of Mining and Metallurgical Engineers, National Open Hearth and Coke oven, Blast Furnace and Raw Materials committees, 30th Annual Conference, Netherland Plaza, Cincinnati—April 21-23.

AMERICAN FOUNDRYMEN'S ASSOCIATION, 51st Annual Meeting, Detroit—April 28-May 1.

Industrial Packaging and Materials Handling Exposition. Industrial Packaging Engineers Association of America, Chicago—April 29-May 1.

Engineers Association of America, Chicago—April 29-May 1.

National Welding Supply Association, Philadelphia, May 5-6.

Society for Experimental Stress Analysis, Stevens Hotel, Chicago—May 15-17.

American Society of Mechanical Engineers, Oil and Gas Power, 19th National Conference, Cleveland—May 21-24.

Association of Iron and Steel Engineers, spring conference, Philadelphia—May 26-27.

American Iron and Steel Institute, New York—May 21-22.

American Society of Mechanical Engineers, Aviation Meeting, Los Angeles—May 26-29.

American Coke and Chemical Institute, French Lick, Ind.—June 9-11.

American Society of Mechanical Engineers, Semi-Annual Meeting, Chicago—June 15-19.

American Society for Testing Engineers, Applied Mechanics Division, Schenectady, N. Y.—June 23-25.

FOUNDRY PERSONALITIES

G. H. Wood has been elected chairman of the board and president, Associated Manufacturing & Foundry Co., N.S.L., recently organized at Albuquerque, N.M. Other members of the board of the new firm are: **William Klein, Sr.; G. H. Atkinson; C. D. Gibson,** and **Dr. J. W. Schroer.**

L. A. Dibble was reelected president, Eastern Malleable Iron Co., Naugatuck, Conn., at a recent board of directors meeting. Other executives of the firm reelected include **C. E. Brust,** vice-president; **Emil Mannweiler,** secretary and treasurer, and **F. L. Howard,** assistant secretary and assistant treasurer.

E. A. Williams, works manager since 1942, has been named vice-president in charge of operations, National Bearing Div., American Brake Shoe Co., St. Louis, and **I. E. Cox,** chief engineer, has been appointed vice-president in charge of engineering for the division. Identified with the firm since 1913, Mr. Williams is a graduate of Pennsylvania State College, and is an A.F.A. member with the St. Louis District chapter. Mr. Cox started with the National Bearing organization in 1935. He attended Washington University, St. Louis, and Union College, Schenectady, N. Y., and was an instructor in electrical engineering at Washington University.

K. L. Walker, head of Walker & Associates, consulting engineers, Detroit, since 1940, has joined Kalamazoo Stove & Furnace Co., Kalamazoo, Mich., as vice-president in charge of operations. A graduate in mechanical engineering of the University of Illinois, Mr. Walker also studied accounting and industrial management at Northwestern University. Prior to founding his own firm, he acquired an extensive background in plant engineering.

F. A. Streiff was recently appointed assistant vice-president, sales department, Southern Wheel Div., American Brake Shoe Co., and will continue to be located in Portsmouth, Va. He has served as Southeastern sales manager for the Southern Wheel Organization and as sales representative, Brake Shoe and Castings Div.

J. G. Risney, formerly sales engineer, International Molding Machine Co., Chicago, has organized his own firm, Risney Foundry Equipment Co., Milwaukee.

William Wilson, Jr., formerly general superintendent of foundries, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., was recently named president, American Light Alloys, Inc., Little Falls, N. J., a new non-ferrous foundry firm. **A. L. Faulconer,** another former Eclipse-Pioneer man, is sales manager of the castings firm.

C. P. Doherty, associated with Despatch Oven Co., Minneapolis, for 27 years, has been named vice-president, member of the board and factory manager. **G. L. Schuster** has been named vice-president, member of the board and chief engineer.

J. F. Pryor, Houston, Texas, has been elected president, Magnolia Airco Gas Products Co.; and **R. A. Merritt,** formerly general manager of sales at Houston, and **J. D. Schwartz,** formerly branch manager at El Paso, have been named vice-presidents. **W. A. Sherman** and **R. F. Crow,** who had served as president and executive vice-president, respectively, continue with the firm as directors.

H. J. Roast, vice president in charge of technical operations, Canadian Bronze Co., Ltd., Montreal, and associated with the organization for the past 13 years, has retired from that position. He will serve as a consultant to the firm and, after a Florida vacation, contemplates moving to California, where he may continue consulting work in the technical field.

J. G. Dick

H. J. Roast

J. G. Dick, associated for the past ten years with Canadian Bronze Co. and with Roast Laboratories, Montreal, has been appointed chief chemist and metallurgist for the Canadian Bronze firm.

Mr. Roast, elected an Honorary Member of A.F.A. in 1946 "in recognition of his many and long continued contributions to the literature and cooperative enterprises of the foundry industry, both in the United States and Canada," served as an A.F.A. Director in 1940-43, and, earlier, as Vice-Chairman, Canadian section of A.F.A. before the organization of the Canadian chapters. He also served as Chairman, Eastern Canada and Newfoundland chapter, and Chairman, A.F.A. Non-Ferrous Division. Author of many technical papers presented before meetings of A.F.A. and other societies, he is a Fellow, Chemical Society, London, and Canadian Institute of Chemistry; a member of the Engineering Institute of Canada, and the American Society for Testing Materials.

E. W. Heffernan has been appointed manager of the new Philadelphia office of Wheelco Instruments Co., Chicago.

William Kerber has been appointed vice-president and general manager, Hanna Furnace Corp., Detroit, succeeding the late **E. Kay Ford.** Mr. Kerber, who was formerly assistant to the vice-president, served as a deputy director, Steel Division, War Production Board prior to joining the firm. He is an active member of A.F.A.

O. B. J. Fraser and **H. J. French** have been elected vice-presidents, International Nickel Co., Inc., New York. Mr. Fraser has been an assistant vice-president of both International Nickel Co., Inc., and International Nickel Co. of Canada, Ltd., since 1943. Mr. French was recently named an assistant vice-president of the Canadian organization.

L. F. Adams, manager, standards division, General Electric Co., Schenectady, N. Y., has been named standards consultant, and **R. C. Sogge,** assistant manager of the general stations division, has been appointed manager of the standards division. The change will permit Mr. Adams to devote time to his activities as president, U. S. National Committee, International Electrotechnical Commission, and as vice-president, standards council, American Standards Association.

Dr. D. S. Eppelsheimer, formerly chief physical metallurgist, Metal Hydrides, Inc., Beverly, Mass., has been appointed associate professor of metallurgical engineering, Missouri School of Mines and Metallurgy, Rolla, where he will be in charge of ferrous metallurgy and x-ray examination of metals. An A.F.A. member, Dr. Eppelsheimer has been with the Metropolitan chapter. He is a graduate of Harvard University, and was previously on the staff, University of New Hampshire, Durham.

R. B. Akins, has resigned as factory manager, Hercules Div., Batavia Metal Products, Inc., Centerville, Iowa, to join the Foundry Division, Electron Corp., Denver, Colo., as general manager. An active member of Quad City A.F.A. chapter in the past, Mr. Akins will join the new Rocky Mountain Empire chapter.

D. B. Milward, associated with the non-ferrous foundry industry for more than 20 years, has been named general sales manager, Michigan Smelting & Refining Div. and Aluminum Refiners Div., Bohn Aluminum & Brass Corp., Detroit.

C. O. Howe, manager, Bentonite Div., F. E. Schundler & Co., Inc., Joliet, Ill., was named to the post of sales manager when the mines and plant of the firm were purchased by Baroid Sales Div., National Lead Co., Los Angeles. He will be located at the new Chicago office. **C. B.**

Schureman, formerly technical consultant for F. E. Schundler & Co., has also been retained by Baroid. Both executives are A.F.A. members, Mr. Howe with Chicago chapter; Mr. Schureman, with Central Illinois chapter.

G. W. Marshall, Jr., has been appointed general sales manager, Asbestos Products Div., Raybestos-Manhattan, Inc., with offices at Chicago. In his new position, Mr. Marshall, who has been with the organization since 1929, will continue as general manager of the asbestos textile and packing division and will direct the activities of the firm's equipment sales division.

Ken O. Hood, Cincinnati district manager, Falk Corp., Milwaukee, has been appointed Pacific Coast district manager for the firm, with headquarters in Los Angeles. He has been associated with Falk for more than ten years. **K. W. Morrissey,** on special assignment at Milwaukee during the war and with the company since 1928, succeeds Mr. Hood as Cincinnati manager.

Robert Hannan **K. O. Hood**

Robert Hannan has been appointed district representative, Beardsley & Piper Co., Chicago, with territory covering Illinois, Iowa, Wisconsin, Minnesota and the peninsula of Michigan. Formerly a service representative, he also has been active in the development, construction and installation of the firm's products.

A. K. Schifflin, district sales engineer, Link-Belt Co., Minneapolis, has been appointed district sales manager, Indianapolis,, with headquarters in the firm's plant there. He succeeds **D. E. Davidson,** who has been named assistant chief engineer at the Pershing Road plant of the company, Chicago.

A. C. Meyers has joined Williams & Co., Pittsburgh, as manager of the nickel department. The company operates plants in Pennsylvania and Ohio and distributes nickel for the International Nickel Co. Mr. Meyers is a specialist in nickel castings. He has been a member of the American Foundrymen's Association since 1928, and is also affiliated with the Pittsburgh Foundrymen's Association and the American Society for Metals.

F. R. Snyder, former foundry metallurgist, John Deere Tractor Co., Waterloo, Iowa, has joined Hickman, Williams & Co., Chicago, as metallurgist. Mr. Snyder joined the Deere firm after receiving his degree in chemical engineering from the University of Iowa in 1934. He became general foreman of the melting and sand control department in 1942. An A.F.A. member, Quad City chapter, Mr. Snyder is also vice-president of the Northern Iowa Foundrymen's Association.

L. E. Everett, senior engineer, Lester B. Knight & Associates, Chicago, has been promoted to vice-president of the firm. An A.F.A. member, he is active in the Chicago chapter.

R. L. Phebus has joined the staff of Carl A. Zapffe, consulting metallurgist, Baltimore, Md. Mr. Phebus has been associated with the metallurgical department, Glenn L. Martin Co. and with the American Rolling Mill Co. He also served as an engineering officer with the U. S. Navy.

D. E. Gilman, formerly associated with J. I. Case Co., Rockford, Ill., recently joined Lester B. Knight & Associates, Chicago, as a survey and industrial engineer. Graduate of the University of Pennsylvania, Philadelphia, Mr. Gilman also studied at Carnegie Institute of Technology, Pittsburgh, Pa.

D. E. Richards, formerly with Ohio Steel Foundry Co., Lima, Ohio, moved recently to Los Angeles, as consultant on industrial relations for C. T. Gilliam & Associates. Mr. Richards has been active in A.F.A. apprentice training activities, and is now a member of the Apprentice Training Subcommittee, A.F.A. Educational Division.

E. G. Leverenz, formerly with Elmes Engineering Works, American Steel Foundries, Chicago, has joined International Harvester Co., Chicago, as process engineer.

Dr. Charles Lipson, formerly head of the stress analysis laboratory, Chrysler Corp., Detroit, has joined Detroit Testing Laboratory, of that city, as a consulting engineer and an associate.

Walter Giger, formerly chief engineer, railway locomotive division, Brown-Boveri & Co., Baden, Switzerland, and, from 1931 through 1937, in charge of railway sales and engineering for the Allis-Chalmers firm, has rejoined Allis-Chalmers. He will represent the company in the transportation field.

A. E. Bock, Sheldons, Ltd., Galt, Ont., has been elected a Director, Ontario A.F.A. chapter. He replaces J. H. McNulty, Canada Electric Steel Casting, Ltd., Orillia, Ont.

C. S. Haagensen has been named manager, employment department, Allis-Chalmers Mfg. Co., Milwaukee, succeeding **J. I. Onarheim,** who has rejoined the firm's sales organization. **M. F. Biancardi** has been appointed to head the health and safety department. Since 1944, Mr. Haagensen had been assistant manager, employment department, and earlier, was assistant to **W. C. Van Cleaf,** director, industrial relations division.

W. H. Fellows **M. F. Surls**

M. F. Surls, formerly metallurgist, Clark Equipment Co., Buchanan, Mich., has joined Charles C. Kawin Co., Chicago, as metallurgist. Prior to his association with the Clark firm, Mr. Surls was research engineer, Michigan Engineering Research Station, East Lansing, and participated in many gray iron research projects. An A.F.A. member, he is a Director of the Michiana chapter.

W. H. Fellows, active in recent years in the sale and manufacture of foundry snagging wheels, has been named abrasive engineer representing Bay State Abrasive Products Co., Westboro, Mass., in Chicago and the Midwest. Graduate of the University of Illinois, where he received a bachelor of science degree in ceramic engineering, Mr. Fellows has been associated, as an assistant ceramic engineer, with the clay and silicate division, National Bureau of Standards, Washington, D. C. He is a member of A.F.A. and its Chicago chapter.

Dr. H. A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland, has been elected an Honorary Member of Association Technique de Fonderie de Belgique, Liege. First American to be so honored by the Belgian group, Dr. Schwartz is an internationally-recognized authority on malleable iron, and is widely known for his contributions to the literature of the castings field. He was awarded the A.F.A. John A. Penton Gold Medal in 1930; and in 1939 the E. J. Fox Gold Medal of the Institute of British Foundrymen. In 1945, Dr. Schwartz presented the A.F.A. Foundation Lecture, his subject being "Solidification of Metals." A prominent figure on many technical committees, he is currently Chairman, Recommended Practice Handbook Committee, Malleable Division, and a member of the division's Executive Committee.

Santos Letona, Fundicion el Rosario, Pueblo, Pue., Mexico, and a member of Mexico City A.F.A. chapter, was a recent visitor to the Association's National Office in Chicago.

R. C. Allen, executive vice-president, Oglebay, Norton & Co., Cleveland, was recently named president of the board of trustees, Battelle Memorial Institute, Columbus, Ohio. He replaces **J. C. Miller,** who will continue to serve on the board. Mr. Allen is a former president of American Institute of Mining and

(Continued on page 194)

A F A MEMBERSHIP

AT NEW RECORD HIGH

MEMBERSHIP IN the American Foundrymen's Association, continuing a steady rise since 1934, was at a new all-time high of 9,364 on April 1. The new peak represents a gain since April 1, 1946 of 1,291 members, or approximately 16 percent, and an increase, compared with the total on April 1, 1945, of 27.6 percent.

Since 1934, when the first A.F.A. chapter was formed, membership in the Association has shown a net increase of 8,125. In its first year, 1896, A.F.A. membership was 345. The 1000-mark was passed in 1917.

The addition of 1,291 members to the roll in the twelve-month period ended April 1 of this year represents the largest membership gain in any like period in the Association's "51 years of growth."

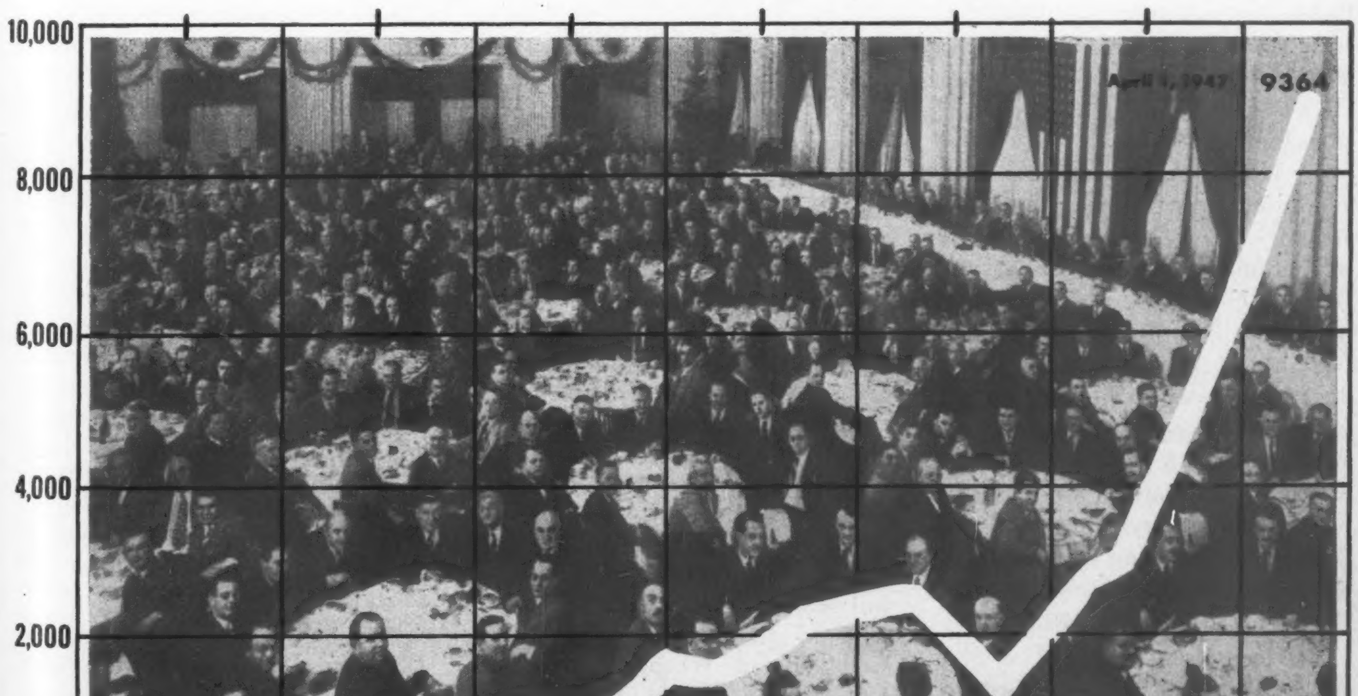
The March 1, 1947 membership total of 9,124 included 191 sustaining members, 1,539 company members, 7,274 personal members, 65 honorary, 73 student and apprentice members. Membership outside the North American continent includes 29 companies and 363 individuals.

Increasing recently at a rate of better than 200 new members monthly, membership in A.F.A., long representative of every division of the castings industry, now extends to every foundry area of North America and to every major foundry center abroad.

On March 1 of this year 7,543 of the members in the United States had chapter affiliations, and membership in the Canadian and Mexican chapters totaled 725. Indicative of both the growth of the chapter movement and of a widening appreciation of the benefits of a chapter contact and of fullest possible participation in A.F.A. activities, only 482 members in North America were without chapter affiliation on March 1.

Participation in the technical, educational and general interest activities of the castings industry, through membership in A.F.A., is not only more widespread industrywise but also broader plant- and companywise. Foundry presidents and vice presidents, general managers and other management officials account for about 25 percent of the Association's membership; production men—the plant managers, superintendents, production and process engineers, foremen and other production control workers—account for nearly 47 percent, while about 9 percent are chemists, metallurgists, research engineers, laboratory technicians and other process control officials.

FIFTY-ONE YEARS OF GROWTH



BRITISH COLUMBIA FOUNDRYMEN
Petition For A.F.A. Chapter Status

A GROUP of seventy British Columbia foundrymen, educators and allied trade members, organized formally at a dinner meeting March 21 in the Pacific Athletic Club, Vancouver, has petitioned the Association's Board of Directors for chapter status, proposing that the organization, with headquarters in Vancouver, be known as the "British Columbia Chapter of the American Foundrymen's Association" and that its territory be that embraced by that province.

The petitioners include or represent twenty-five foundries, three educational institutions and four foundry equipment and supply firms. Charter membership, in terms of A.F.A. classifications, includes nineteen companies, thirty-four personal-affiliates, five educational and twelve personal members.

Officers of the group, elected at the organizational meeting to serve until October, are Norman Terry, secretary-treasurer, Canadian Sumner Iron Works Ltd., chairman; Thomas Cowden, general manager, Wm. McPhail & Sons (Canada) Ltd., vice chairman, and L. P. Young, metallurgist, A-1 Steel & Iron Foundry Ltd., secretary-treasurer. All are Vancouverites.

Elected directors of the organization for the March-October term were W. H. Armstrong, assistant professor, Department of Mining and Metallurgy, University of British Columbia; J. A. Dickson, owner, Dickson Foundry Co.; F. E. Done, superintendent, Reliance Foundry Co. Ltd.; H. A. Sturrock, managing director, Associated Foundries; J. Hughes, Vancouver Engineering Works Ltd.; J. S. Graham, assistant manager, Mainland Foundry Ltd.; F. Bay, superintendent, Vivian Engine Works Ltd., and H. J. Turney, manager, Westland Iron & Steel Foundries Ltd., all of Vancouver.

Active interest in formation of a British Columbia chapter, expressed as early as October 1946, resulted January 20 in an "expectancy" meeting at which twenty-five foundrymen and educators enthusiastically endorsed the movement and appointed a steering committee headed by Norman Terry and comprising L. P. Young, as secretary, H. J. Turney, W. M. Armstrong, Thomas Cowden, J. A. Dickson and J. F. Ross, assistant manager, Ross & Howard Iron Works Co. Ltd.

With Mr. Terry presiding, the organizational meeting March 21 heard reports of the steering committee, elected officers and directors, unanimously approved the petition for chapter status and viewed a number of foundry films presented by Dean Goard of the Vancouver Technical School.

If approved by the Association's directors, the British Columbia group will become the 37th A.F.A. chapter and its third in Canada.

Vote To Organize For New Michigan Chapter

A GROUP of forty-one southern Michigan foundrymen and members of allied trades, meeting in Marshall, Mich., March 14, voted unanimously to organize and to petition the Board of Directors of A.F.A. for chapter status.

The vote to seek admission as an A.F.A. chapter followed full discussion of the advisability of forming an independent organization of foundrymen and equipment and supply company representatives in the area bounded by Lansing, Jackson, Kalamazoo and Coldwater-Hillsdale.

Temporary officers named were D. J. Strong, president, Foundry Materials Co., Coldwater, chairman; John Secor, sales representative, Hill & Griffith Co., Niles, vice chairman, and Fitz Coghlin, Jr., metallurgist, Albion Malleable Iron Co., Albion, secretary-treasurer.

To serve, with the temporary officers, as members of a steering committee the group named O. J. Drumm, foundry manager, Battle Creek Bread Wrapping Machine Co., Battle Creek; K. Buelow, foundry superintendent, Marshall Furnace Co., Marshall; John Granger, manager, Calhoun Foundry Co., Inc., Homer; H. McCoy, superintendent, Albion Malleable Iron Co., Albion; W. E. Fisher, manager, Reed Manufacturing & Machine Co.; E. Doerschler, superintendent, U. S. Foundry Corp.; Edward Schlepp, foundry superintendent, and L. H. Stryker, Riverside Foundry & Galvanizing, all of Kalamazoo.

A.F.A. Secretary-Treasurer W. W. Maloney, Detroit Chapter Chairman A. H. Allen and Michiana Chapter Chairman John McAntee met with the group's temporary officers and steering committee members in Marshall March 24 to discuss questions concerning the new chapter movement and iron out any territorial matters which might be involved. Blizzardy weather prevented the attendance of the chairmen of other neighboring chapters.

First steps toward organization of the southern Michigan group were taken in Marshall January 30. At that meeting Mr. Schlepp and others discussed the advantages of organization and cooperative action on common problems and outlined the work of A.F.A. and its various chapters.

Will Outline Chapter Educational Work

CHAPTER CHAIRMEN, heads of educational and apprentice training committees and foundrymen interested in foundry personnel problems are invited to attend the A.F.A. Educational Division's business meeting, April 28, at the Rackham Educational Memorial in Detroit.

Fred Sefing, Chairman of the Division, directed a special message to A.F.A. chapter leaders pointing out that the Detroit conference afforded them a good opportunity to study the A.F.A. Educational Program and to learn how foundry educational work can be organized. Educational Division members will be available for questioning and chapter programs which have been successful will be described.

Chapters having no Educational Committee or Apprentice Training Committee are urged to organize such units and to appoint a chairman who can attend the Detroit meeting and secure the background information to start a program.

★ CHAPTER ACTIVITIES ★

news

BUSY STORK DELIVERS AGAIN
Tri-State Becomes 36th A.F.A. Chapter

TRI-STATE A.F.A. CHAPTER, 36th of the Association and its newest "baby," was installed at its first regular meeting February 28 at Tulsa, Okla. Inclement flying weather grounded A.F.A. National Director F. M. Wittlinger, Texas Electric Steel Casting Co., Houston, who was to present the famous cast iron rattle, and Texas chapter Director J. O. Klein, Texas Foundries, Inc., Lufkin, scheduled technical speaker; and the stork, flying high, performed unassisted. (Later, the giant bird hovered interestedly above a blizzard at Marshall, Mich., and then looked in at Vancouver, British Columbia, Canada.)

Wire Received

"Regret exceedingly that flight conditions prevent attendance at this, your first, meeting to welcome you officially as the newest chapter of A.F.A. and to meet each of you personally," Messrs Wittlinger and Klein wired the Tri-State foundrymen. "Please accept sincere wishes for a healthy chapter, a long, profitable existence."

J. W. Kelin, Federated Metals Div., American Smelting & Refining Co., St. Louis, a member of St. Louis District A.F.A. chapter, was speaker of the evening on "Chapter Possibilities." Drawing upon his background as a chapter officer and director, Mr. Kelin outlined for the foundrymen of the Tri-State group the functions of an Association chapter, the manner in which it serves the foundries of its area and grows in membership, and the benefits to members of organized technical, educational and other activities. He stressed the importance of active participation by every individual in the work of the new chapter and the A.F.A.

Chapter Vice-Chairman and Program Committee Chairman Anton Johnson, Oklahoma Steel Castings Co., Tulsa, introduced the speaker and, later, presented through courtesy of his firm, films on "Design, Promotion and Physical Properties of Steel Castings."

Official Installation

Chapter Chairman R. W. Trimble, Bethlehem Supply Co., Tulsa, who presided at the business session, announced official installation of the chapter and presented a brief summary of the organizational steps leading to submission of a petition for chapter status to the A.F.A. Board of Director and approval by the Board.

Northeastern Ohio

Pat Dwyer and
R. H. Hermann
Penton Publishing Co.
Chapter Reporters

TWO TECHNICAL SESSIONS were featured at the February 13 meeting of Northeastern Ohio A.F.A. chapter. Light metal foundrymen heard M. E. Brooks, Dow Chemical Co., Bay City, Mich., and L. W. Davis, Aluminum Co. of America, Cleveland, discuss the technology and production methods of magnesium and aluminum; while the patternmaking division, meeting separately, had a panel of speakers on "Gadgets," "New Methods for Old Machines" and "Glues."

Speaking on "Gadgets," Charles Wilberschied, Master Pattern Co., Cleveland, discussed portable and fixed routers, corners rounders, portable sanders, air and electric grinders, and their applications. He also described a layout arrangement which permits a job to be worked on from any angle.

Ernie Klippstein, New Age Woodcraft Co., Cleveland, analyzed a number of time-saving methods applicable to wood patternmaking with standard equipment. Cutting of worms and teeth for gears with a band saw was outlined.

Types and characteristics of glues and practices relating to their applications were described by E. W. Pierie, Motor Patterns Co., Cleveland, who also covered the effects

of various glues on patternmaking tools. Cold hide glue, he said, is more moisture resistant and elastic and easier on tools than a hot adhesive mixture. A glue is only as good, however, as the wood used in the pattern, he advised.

Chapter Director Frank Cech, Cleveland Trade School, served as moderator for the panel session.

Chapter President H. J. Trenkamp, Ohio Foundry Co., Cleveland, presided at the dinner meeting and business session. Announcement was made that the chapter is sponsoring a local apprentice contest in cooperation with Associated Industries of Cleveland, with winning castings and patterns to be entered in the A.F.A. Annual Apprentice Contest. Cash prizes are offered for local winners. Molding will take place in the foundry where the apprentice is employed; and patternmaking, at Cleveland Trade School.

Connecticut Non-Ferrous

L. G. Tarantino
Niagara Falls Smelting & Refining Corp.
Association Secretary

FOUNDRY APPLICATIONS of infrared drying was the topic of the technical session, February 19, at the meeting of Connecticut Non-Ferrous Foundrymen's Association in New Haven. Fritz Uhlenhaut, Industrial Service, Inc., New Haven, was the speaker for the occasion.

Skin drying of sand molds is accomplished through absorption of the infra-red rays in the sand containing moisture, Mr. Uhlenhaut explained. The heat is direct and concentrated, with lamps banked about four inches above the top plane of the flask in a typical installation. Only fifteen minutes are required to dry molds to a depth of one-quarter to one-half inch, he said, in discussing mold drying.

Other applications cited were drying of chaplets, abrasives on grinding wheels, and cores.

Core Drying

In response to questions during the general discussion period, Mr. Uhlenhaut said that drying time for cores with synthetic binders is ten minutes per inch of thickness up to four inches (the method is not considered practical for more than four inches); cores of uneven sections will be heated in relation to thickness, the thinner sections drying more rapidly. Infra-red has no advantage over other methods in drying large cores; life of infra-red lamps is five thousand hours or more. The speaker outlined precautions against lamp breakage and burns received from infra-red lamps.

At the January 15 meeting of the group, Claude Cady, Park City Pattern Works, Bridgeport, Conn., spoke on "Production and Job Patterns for Non-Ferrous Foundry."

Pattern equipment of good quality always pays dividends in better castings and increased pattern life, Mr. Cady said. Life of the pattern depends on the care given it and the type of foundry, he pointed out. Keep scrap out of the sand, pay close attention to the condition and operation of mold squeezing machines, have plate in correct position, and give proper supervision and care to equipment to obtain maximum performance, he advised foundrymen.

Engineer, patternmaker and foundryman should consult on design of the casting, Mr. Cady said. Section thickness, gating and the proper alloy for the casting application are factors to be considered.

Flask Thickness

The speaker noted that, in aluminum plates, the use of heat-treatable alloys has not been found necessary. He said that recommended thickness of plates for standard flasks is $\frac{5}{16}$-in. and that no springing should occur under normal usage. Aluminum core boxes, he pointed out, are considered reasonable as replacements for iron core boxes, and are, themselves, more readily replaced. He added that beryllium copper inserts may be used in core boxes to prevent excessive wear, and that chromium or nickel plating of pattern plates is difficult, since the surface must be

A packed house featured the March meeting of the Philadelphia chapter.

Informal scenes taken at the February 14 Southern California chapter meeting held in Roger Young Auditorium, Los Angeles.

perfect to assure good plating.

Referring to pattern detail identification, Mr. Cady cited the work of the A.F.A. committee on pattern marking which is working toward establishment of a standard color identification scheme.

Rochester

D. E. Webster
American Laundry Machinery Co.
Chapter Director

W. B. WALLIS, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa., nominee for A.F.A. Vice-President for 1947-48, spoke on "The Future of the Arc Furnace in the Foundry Industry" at the technical session of the Rochester A.F.A. chapter meeting February 11.

Since its introduction as a melting or remelting unit, the electric furnace has undergone outstanding refinement in control and has found a constantly expanding field of application, Mr. Wallis said. Radically new applications have been developed in the past few years, he said.

Furnace Flexibility

Flexibility of the unit makes possible its use in the production of a high grade product from cast iron borings, he added; and, in the production of stainless steel, the electric furnace yields metal of the highest quality under close metallurgical control. Mr. Wallis explained the use of oxygen or air directed on the surface of the bath and described ingot manufacture with the arc furnace.

Northern California

C. R. Marshall
Chamberlain Co.
Chapter Co-Secretary

R. A. QUADT, chief research metallurgist, Federated Metals Div., American Smelting & Refining Co., Perth Amboy, N.J., was technical speaker at the February meeting, held in San Francisco.

In his talk, based on observations from his experiences with problems encountered by aluminum casting alloys users, Mr. Quadt emphasized that the casting of aluminum, a practice that has existed only for a generation, is not tradition-bound. The first phase of good practice concerns the condition of the metal to be melted, he pointed out, adding that particular attention must be given possible surface corrosion resulting from adverse storage conditions, a prime cause of pin-hole porosity.

Speaking of melting and pouring practice, Mr. Quadt stressed the importance of avoiding gas pick-up. Atomic hydrogen, soluble in aluminum, can be introduced into the metal through products of combustion; combined water from ladles and skimmers; absorption through crucibles, and fluxes.

Turbulence created in the metal during the transfer of molten aluminum and the pouring of molds should be held to a minimum in order to avoid excessive formation of oxides, the speaker said. Best practice indicates straight melting, bringing the melt up to above pouring temperature and then cooling to that temperature, he pointed out. Maximum pouring temperature is generally considered to be 1450° F, although special alloys, such as those containing titanium, may be poured in a higher range.

Concerning iron pick-up, Mr. Quadt observed that it is not necessarily detrimental unless the amount exceeds approximately 1½ per cent. Provision for adequate feeding must be made in mold and casting design, he said, but added the important factor is venting.

George McDonald, H. C. Macaulay Foundry Co., Berkeley, chapter program chairman, introduced the speaker. Chapter President Richard Vosbrink, Berkeley Pattern Works, Berkeley, presided at the business meeting. He announced that arrangements for classrooms and instructors for the chapter's current apprentice training course had been completed. More than 40 apprentices of the area will attend the course.

Northwestern Pennsylvania

J. E. Gill
Lake Shore Pattern Works
Chapter Director

FOUNDRYMEN of Northwestern Pennsylvania A.F.A. chapter heard two technical speakers in February, as the Venango group held a meeting, one of its three for the year, in Oil City on the 21st, and the chapter's regular meeting was held the 24th in Erie.

Chapter Chairman E. M. Strick, Erie Malleable Iron Co., presided at Erie, where W. E. Sicha, Aluminum Co. of America, Cleveland, spoke on "Aluminum Alloys—Castings, Fabrications, Applications."

Sand, permanent mold and die casting of aluminum were covered in the speaker's presentation, as were such other methods as rolling, extruding and drawing.

Questions raised during the general discussion period were largely concerned with sand casting. Mr. Sicha, member of the Research and the Shrinkage and Porosity committees, A.F.A. Aluminum and

Top—Interest in the lecture course sponsored by the Saginaw Valley chapter is well illustrated here as members listen attentively to Don Bowman, Almont Mfg. Co., Imlay City, Mich., discuss "Molding and Coremaking." Bottom (left to right)—Frank Bean, General Foundry & Machine Co., Flint, Mich.; Don Bowman; Chapter Chairman John Smith, Chevrolet Grey Iron Foundry, Saginaw, Mich.; and Marshall Chamberlain, Dow Chemical Co.

Magnesium Division, analyzed the nature and causes of such defects as gas porosity, inter-granular corrosion and voids, and outlined corrective practices.

Dr. J. A. Ridderhoff, Frederic B. Stevens, Inc., Detroit, presented a technical paper on "Core and Mold Coatings" at the Oil City meeting.

Use of Coatings

Coatings are an aid to good sand and good foundry practice, he told the foundrymen, but they will not hide, nor compensate for, poor sand or careless mold or coremaking, and will not prevent rat tails or scabs if the sand cracks.

Core and mold coating form a separating film between sand and metal, facilitating removal of sand from castings, Dr. Ridderhoff explained. They prevent sand from sintering to metal, prevent metal penetration by filling in the spaces between the sand grains, and promote better finishes on castings by providing a surface smoother than that of the sand. Special types of washes to seal the sand against penetration by phosphor bronzes and similar "searching" metals, are commercially available, he added.

Penetration of the wash into the sand is important and, as casting thickness increases and pouring temperature rises, the wash must penetrate deeper, the speaker said. Other recommendations advanced by Dr. Ridderhoff included:

Store containers of coating powder in a dry place, as a precaution against fermentation; standardize all solutions, making exact measurements of the proper mixture components and maintaining the same proportions in following batches; limit to 10 or 15 per cent, additions of other materials to coating products, unless more bentonite and binder are added; for deeper penetration, spray on the wash—a pistol type gun is advised for large cores or molds, an atomizing type, for small to medium cores or molds.

Chapter Director T. H. Beaulac, Chicago Pneumatic Tool Co., Franklin, Pa., was presiding officer for the Venango group.

Central Ohio

D. E. Krause
Battelle Memorial Institute
Chapter Reporter

SECTIONAL MEETINGS were featured at Central Ohio A.F.A. chapter February 24, with J. B. Caine, Sawbrook Steel Casting Co., Cincinnati, presenting a paper on "Scabbing and Buckling" in steel foundry practice, and E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland, addressing the gray iron and malleable group on control of core sand properties.

Sand control starts with the specification of raw materials, Mr. Zirzow said. In cases where only a limited number of sand tests can be performed, moisture content determinations should be included, since moisture control is considered by far the most important aspect.

Sand tests themselves are relatively useless unless their results are correlated with actual foundry experience, the speaker pointed out, adding that, despite the considerable amount of effort directed to sand control, there are still many unknowns. He expressed the opinion that within ten years other tests will supplant those now used.

Describes Tests

Mr. Caine stated that most of the widely accepted sand tests yield little direct information on the problem of scabbing and buckling; and described a test he had developed to obtain such information:

Sand to be tested is rammed up into standard A.F.A. 2-in. diameter test cylinders. Before the specimen tube is filled, a steel nut for a half-inch bolt is placed at the center in the bottom. Wire stubs, welded to the nut, support the sand, so that the sand cylinder can be withdrawn by a half-inch threaded rod which is screwed into the nut.

The effect, upon the sand, of conditions in the cope face of a

mold may be obtained by holding the cylinder just above the surface of molten steel in a hand ladle. By immersing the sand cylinder in the molten steel, it is possible to reproduce conditions corresponding to those in the drag face of a mold; and the effect of metal flowing somewhat intermittently (as over elevated surfaces in the drag into deep cavities) may be approached by alternate immersion and withdrawal of the sand cylinder.

Although thousands of cylinders have been tested, results obtained do not always agree with theories concerning the behavior of sands at high temperatures, Mr. Caine said. Since actual mold conditions are simulated, he pointed out, results are more readily interpreted than those of other tests. Corn or wheat flour additions to bentonite-bonded sands are essential, if scabbing or buckling are to be avoided, Mr. Caine advised.

Rocky Mountain Empire

J. R. Maclear
Maclear Mfg. & Supply Co.
Chapter Reporter

"Industrial hygiene in the foundry industry" was the technical session topic at the February 25 meeting of Rocky Mountain Empire A.F.A. chapter in Denver. F. W. Church, chief of the division of industrial hygiene, University of Colorado, Boulder, was speaker.

He detailed requirements for proper safety and health precautions in the shop and urged the foundrymen to analyze conditions in their departments in view of such requirements. Chapter Chairman J. L. Higson, Western Foundry, Denver, was presiding officer.

Texas

W. H. Lynne, III
Hughes Tool Co.
Chapter Reporter

"The Future of Castings in Highly Stressed Machine Parts" was the topic of Dr. D. J. Martin, Hughes Tool Co., Houston, technical speaker at the February 21 meeting of Texas A.F.A. chapter in Houston.

Dr. Martin, during the war a colonel in the office of the Chief of Ordnance, Washington, D.C., and in charge of design development and production of cannon, took the centrifugally-cast gun tube and statically-cast breech rings as examples of castings used under high stress. In the course of his remarks he traced the history of castings in ordnance from the brass cannons of old through the high tensile steels of World War II.

Metropolitan

B. K. Price
Penton Publishing Co.
Chapter Reporter

A.F.A. Officers and Directors were guests of Metropolitan chapter March 3 at Newark, N. J.

Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., nominee for President in 1947-48; Secretary-Treasurer W. W. Maloney; National Director H. A. Deane, American Brake Shoe Co., New York, and W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, nominee for 1947-48 Vice-President, were featured on the chapter's National Officers Night program.

Following brief addresses by Vice-President Kuniansky and Mr. Wallis, Secretary Maloney announced installation of the 36th A.F.A. chapter, the Tri-State group, with headquarters in Tulsa, Okla., and told the foundrymen that the Association membership had reached an all-time high of more than nine thousand. He congratulated Metropolitan chapter on attaining a membership peak of 375 members.

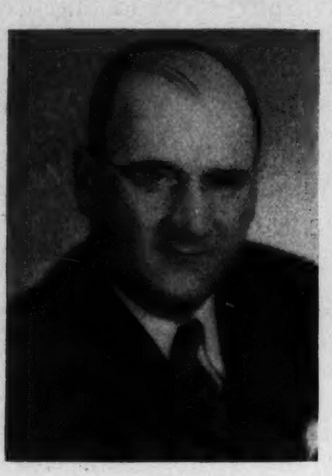
Topic of the technical session was "Foundry Sands," discussed by a panel of four speakers: R. J. Maddison, Whitehead Bros. Co., New York; J. W. Mentzer, Taggert & Co., and G. F. Pettinos, George F. Pettinos, Inc., both of Philadelphia, and H. J. Williams, New Jersey Silica Sand Co., Millville.

Discussing Albany sand, Mr. Maddison described it as versatile, easy working, highly durable and not critical with respect to temper water. Albany sand, he said, has been in continuous production for more than 100 years and has, inherently, such valuable properties as flowability, peel from casting and low expansion and contraction grain characteristics.

Properties of sands from the Millville, Mt. Holly and Glenrock districts, were detailed by Mr. Pettinos, who confined his remarks to New Jersey bonded sands. There is a place in the foundry for each of these sands, he said, adding that sand troubles too often arise from poor selection of sand for the purpose required, such as choice of a sand with too high moisture.

Annual Ladies Night party sponsored by the Chicago chapter was held at the Palmer House, Chicago, February 15. The ladies look as though they are enjoying the night out with their "hubbies."

CHAPTER OFFICERS



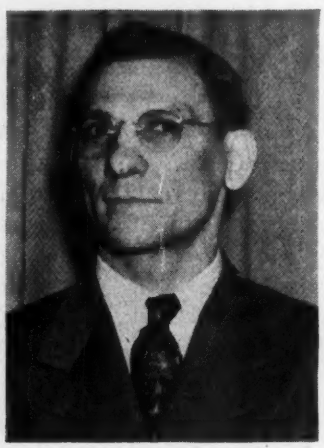
R. R. Haley
Advance Aluminum & Brass Co.
Los Angeles
Director
Southern California Chapter

M. T. Ganzauge
General Railway Signal Co.
Rochester
Director
Rochester Chapter

R. W. Mattison
Mattison Machine Works
Rockford, Ill.
Director
No. Illinois & So. Wisconsin Chapter

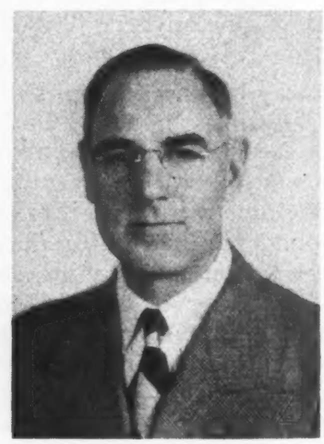
J. S. Hornstein
Meadville Malleable Iron Co.
Meadville, Pa.
Director
Northwestern Pennsylvania Chapter

A. B. McCullough
American Steel Castings Co.
Newark, N.J.
Director
Metropolitan Chapter

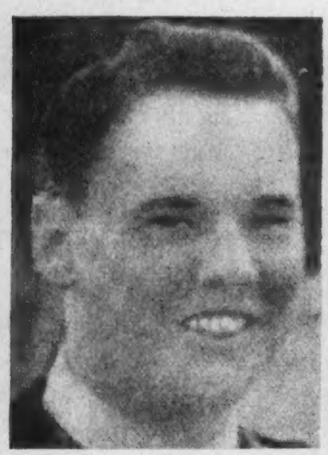


Rudolph Flora
Clover Foundry Co.
Muskegon, Mich.
Chairman
Western Michigan Chapter

M. V. Chamberlin
Dow Chemical Co.
Midland, Mich.
Vice-Chairman
Saginaw Valley Chapter

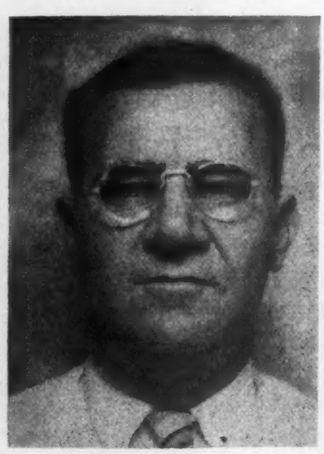


R. E. Woods
M. W. Warren Coke Co.
St. Louis
Secretary
St. Louis District Chapter



C. A. McNamara, Jr.
Big Four Foundry Co., Inc.
Tulsa, Okla.
Secretary
Tri-State Chapter

H. V. Witherington
H. W. Butterworth & Sons Co.
Philadelphia
Director
Philadelphia Chapter



W. E. Hackmuth
Houston Foundry & Machine Co.
Houston
Director
Texas Chapter

C. E. Stull
Manufacturers Foundry Corp.
Denver, Colo.
Secretary
Rocky Mountain Empire Chapter

Cincinnati District chapter does not believe in confining itself to male activities; they recently sponsored a dinner dance at the Netherland Plaza Hotel, Cincinnati, which it is apparent the ladies enjoyed.

Trouble arises, too, Mr. Pettinos stated, from a tendency on the part of foundrymen to try for too much mileage from bonded sand and from the use of excessive add mixtures. In buying sand foundries should pay close attention to the specifications to be met and should obtain all the facts concerning the sands under consideration before a decision is reached.

Silica Sand Production

Mr. Mentzer, discussing gravel, urged the foundrymen not to add too many other ingredients. Gravel, properly used in accordance with data available, will give few complaints, he said. Mr. Williams outlined modern methods for producing silica sands. He pointed out that great strides have been made in the past 25 years, and that a variety of analyses, all based on laboratory test results, can be obtained.

Chapter Chairman H. L. Ullrich, Sacks-Barlow Foundries, Inc., Newark, was general chairman, and G. F. Watson, American Brake Shoe Company, Mahwah, New Jersey, technical chairman.

Michiana

S. F. Krzeszweski
American Wheelabrator & Equipment Corp.
Chapter Director

LOCAL FOUNDRIES were hosts to members and guests of Michiana A.F.A. chapter March 4 at Elkhart, Ind., during an afternoon tour preceding the dinner meeting, there. Chapter Director K. A. Nelson, Chicago Hardware Foundry Co., headed the reception committee, representing Elkhart-area plants, which had invited the chapter membership to visit plants in the region.

Chapter Vice-Chairman J. H. Miller, Josam Products Foundry Co., Michigan City, Ind., presided at the dinner meeting, and expressed to the Elkhart delegation the chapter's appreciation of a program that included entertainment and refreshments in addition to the tour of local foundry and pattern shops.

J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, spoke on "What Do We Know About Sand?" at the technical session. He was introduced by Chapter Director and program committee chairman, Earl Byers, Sibley Machine & Foundry Co., South Bend, Ind.

Bentonite Comparison

Applications of Southern and Western bentonite were compared by Mr. Caine, who went into detail as to proper sand practice for production of better castings. The speaker, Chairman of the Mold Surface Committee, A.F.A. Sand Division, also presented an analysis of causes of adhesion of sand to castings. Such sand, he said, is usually referred to as, "burned on," although it might more properly be considered "mechanically locked" to the surface of the metal.

In the general discussion period that followed his remarks, Mr. Caine, who is also a member of the Sand Division's Program and Papers and Executive committees, described recent technological developments in sand control.

Western New York

L. C. Thellemann
Kencroft Malleable Co.
Chairman, Publicity Committee

FOUNDRY TECHNOLOGY of ancient times triumped over heart breaking obstacles, A.F.A. National Director B. L. Simpson, National Engineering Co., Chicago, told foundrymen of the Western New York A.F.A. chapter area, meeting March 7 in Buffalo.

Reviewing "The History and Development of the Foundry Industry," Mr. Simpson pictured progress in the art of casting metals in a presentation of numerous slides. Large and intricate castings were produced by foundrymen of ancient times without the benefits of modern scientific knowledge, equipment or instruments, he stressed. Through perseverance and skill they achieved amazing results, and castings surviving are works of art, he said.

Chapter Chairman H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, presided at the business session. M. J. Doelman, National Engineering Co., Buffalo, was technical chairman.

A new creation of the chapter, announced at the meeting, is a monthly publication, designed to serve as a means of communication between members and officers and committee chairmen and facilitate exchange of information between local foundrymen. F. E. Bates, Worthington Pump & Machinery Co., is editor.

Chesapeake

J. A. Reese
Koppers Co.
Chapter Reporter

FOUNDRYMEN of Chesapeake A.F.A. chapter were guests of the Baltimore chapter, American Society for Metals, at a joint meeting March 17 in Engineering Society Headquarters. "Cast Metals—Their Design and some Metallurgical and Engineering Considerations" was the topic of the technical speaker, Dr. C. H. Lorig, Battelle Memorial Institute, Columbus, Ohio, who is chairman, A.F.A. Steel Division.

Discussing the metallurgical, engineering and economic aspects of the foundry industry, Dr. Lorig dwelt on the effects of the transition period on the castings field. He cited recent technological advances and analyzed their role in keeping foundries abreast of market demands. These remarks were highly interesting to those present.

Controlling Properties

Metallurgically speaking, he said, cast iron, with its matrix of ferrite, graphite and carbides, is more complex than steel; however, a foundryman with the proper technical background is familiar with the variables and can control properties at will. Speaking of magnesium alloys, he pointed out that, contrary to popular belief, these alloys are corrosion resistant.

A.F.A. Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., introduced Dr. Lorig. Technical chairman was Dr. T. C. Jarrett, chief metallurgist, Piston Ring Div., Koppers Co., Baltimore. Dr. C. A. Zappfe, metallurgical consultant, Baltimore, presided over the technical session.

For the chapter's February 28 meeting, the technical subject was "Sand Properties and their Relation to Casting Defects," by L. A. Taylor, Illinois Clay Products Company, Joliet, Illinois.

Defective castings cost the foundry industry millions of dollars in scrap losses every year, Mr. Taylor stated, adding that 22 of the 30 defects listed by the A.F.A. Casting Defects group can be ascribed to sand.

Proper sand control, the speaker said, will eliminate many casting defects. The principal effects of various treatments on the properties of gray iron were summarized.

An increase in moisture causes loss in green compressive and sheer strength, a decrease in permeability, an increase in dry compressive and dry shear strength. Harder ramming on a sand bonded with clay decreases permeability and increases green compressive, green sheer and dry compressive strength and mold hardness. Addition of seacoal to clay-bonded sand decreases permeability and increases dry compressive and dry shear strength, the speaker said.

Central Indiana foundrymen heard A. J. Tuscany (top photo, second from left) executive secretary, Foundry Equipment Manufacturers Association, Cleveland, discuss "Future Possibilities of the Foundry" at the meeting held in the Athenaeum, Indianapolis.

Sand Selection

In regard to selection of a base sand, Mr. Taylor stated that sand is selected on the basis of core room needs, and used core sand is then added to the molding sand.

Sand of well-rounded grain has greatest permeability, he said, but, for equal strength, requires more bond than sand of subangular grain. Distribution of grain size for a good molding sand should be such that 70-80 per cent of the sand remains on four adjacent screens, the balance distributed.

Mr. Taylor presented recommendations as to remedies for typical defects: sand "drop" in mold caused by low resilience, add new sand and/or binders; "cat whiskers" or veining attributable to small fissures opening in the sand, add cereal binder, clay bond or seacoal if caused by expansion—reduce seacoal, add pitch or iron oxide, if contraction is the cause.

"Rattail" produced by buckling of the sand, nearly always in the drag, requires reduction in expan-

An informal session of the educational committee, Birmingham District A.F.A. chapter, was held for the cameraman at the January 17 meeting in the Tutwiler Hotel, Birmingham: left to right, E. A. Thomas, Thomas Foundries, Inc.; C. P. Caldwell, Caldwell Foundry & Machine Co., and, chairman, Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham.

sion of the sand through addition of combustible material which will burn out (seacoal, wood flour, cereal binder). Gas seam on light castings, which appears on vertical surfaces only and is similar to "rat-tail," but treaceable to gas pressure between sand and metal, may be remedied by providing more vents and increasing the permeability of the sand.

Misruns may be caused by back pressure of mold gases, in which case permeability should be increased and moisture and carbonaceous matter in the sand, reduced.

St. Louis District

J. W. Kelin
American Smelting & Refining Co.
Chapter Reporter

KEEN INTEREST in "Human Relations in the Foundry," topic of the March 13 meeting in St. Louis, was evidenced by foundrymen and patternmakers of the St. Louis District A.F.A. chapter area through an unusually large attendance and a lively and prolonged general discussion session. S. G. Garry, labor relations department, Caterpillar Tractor Co., Peoria, was speaker.

Procedures in handling grievances and relationships between workmen and foremen, plant superintendents and others in management personnel were detailed by Mr. Garry, who serves on the A.F.A. Educational Division Industrial Training Committee and is Chairman of its Subcommittee on Foreman Training. He stressed the importance of goodwill and cooperation and submitted a number of fundamental rules as proven aids to maintenance of relationship.

Chapter Director L. A. Kleber, Central Steel Castings Corp., Granite City, Ill., directed general discussion, during which the speaker, in response to questions from the floor, enlarged upon a number of points made during his formal presentation to the members.

Chapter Chairman R. T. Leisk, American Steel Foundries, East St. Louis, Ill., presided at the dinner and the business meeting. W. A. Zeis, Webster Groves, Mo., chapter membership chairman, reported membership of the chapter the largest in its history. Chapter Secretary R. E. Wood, Warren Coke Co., St. Louis, spoke briefly on the 51st Annual Convention of A.F.A., and F. W. Burgdorfer, Missouri Pattern Works, St. Louis, described the local apprentice contest, pre-

Cincinnati District

E. F. Kindinger
Williams & Co.
Chapter Secretary

CASTINGS ARE PARAMOUNT in machine tools, A. C. Denison, Fulton Foundry & Machine Co., Cleveland, told Cincinnati District A.F.A. chapter foundrymen at their March 10 meeting in Engineering Society Headquarters.

Discussing "Weldments vs. Castings," Mr. Denison advised that units which are complicated and vital for precision work, and in which machinability is a factor, should be cast. They may be of welded construction, he suggested, if not too complicated, or if accuracy is not required. The speaker featured in his remarks a comparison of mechanical properties of castings and weldments.

Chapter Chairman J. S. Schumacher, Hill & Griffith Co., Cincinnati, was the presiding officer.

Southern California chapter officers pause with February speaker L. A. Behrendt (center, seated), Joseph Dixon Crucible Co., Jersey City, N.J. Standing are Chapter Vice-President H. E. Russill, Eld Metal Co. Ltd., (left); and Chapter President W. D. Emmett, Los Angeles Steel Casting Co.; and seated (left) E. D. Shomaker, Kay-Brunner Steel Products, Inc., Alhambra; and L. O. Hofstetter, Brumley-Donaldson Co.

liminary to the A.F.A. Annual Apprentice Contest, and announced that district patternmakers were offering prizes for local winners.

New England

M. A. Hosmer
Hunt-Spiller Mfg. Corp.
Association Reporter

"MELTING PROBLEMS OF TODAY" were analyzed by F. W. Hanson, metallurgical engineer, service and development department, Electro Metallurgical Co., New York, at the March 12 meeting of the New England Foundrymen's Association in Boston.

Low silicon pig irons contain more carbon than those high in silicon, Mr. Hanson pointed out, "a fact of interest to foundries where high carbon percentages must be maintained."

Cupola Versatile

Outlining the versatility of the cupola as a melting unit, the speaker went on to describe the possibilities of substitution of different grades of melting materials for those more commonly used but not readily available today. He discussed the effect of incidental elements, such as sulphur and phosphorus, occurring increasingly in available scrap, and detailed suggestions for eliminating some of the resulting difficulties.

Speaking of inoculating alloys, Mr. Hanson stressed the advisability of the foundryman furnishing his inoculant source with information regarding the composition of melts when the type of scrap used varies from usual components. In this regard, he presented slides showing the effects of different alloying materials in irons of varying compositions.

President D. L. Parker, General Electric Co., Lynn, Mass., presided at the dinner which attracted a representative turnout of foundrymen from the New England area.

Saginaw Valley

J. J. Clark
General Motors Corp.
Chapter Director

GUEST SPEAKER for the technical session of the March 6 meeting of Saginaw Valley A.F.A. chapter in Frankenmuth, Mich., was Zigmond Madacey, Caterpillar Tractor Co., Peoria, Ill., Chairman, Central Illinois A.F.A. chapter. His topic was, "Core Blowing."

By means of suitable rigging, Mr. Madacey said, it is possible to produce cores economically in short runs—as few as 25 pieces—with approximately two minutes required for changing from one box to another. He exhibited, by means of slides, core boxes, rigging and cores produced.

Central New York

J. A. Feola
Crouse-Hinds Co.
Chairman, Publicity Comittee

A FOUR-POINT PROGRAM for "Safety in the Foundry" was outlined at Central New York A.F.A. chapter's, March 14 meeting in Syracuse by R. R. Meigs, loss prevention department of the Liberty Mutual Insurance Company, Boston, Massachusetts.

Create a broad conception of the value of accident prevention; organize for accident prevention; tackle materials-handling operations from a safety standpoint and do a better job of housekeeping, Mr. Meigs advised his audience.

Safety is the "must" that goes with the slogan, "The Foundry is a Good Place to Work," he said. Safety should be considered, not as a minor undertaking, but as a broad activity having to do with better utilization of manpower, improvement of industrial public relations and whole-hearted cooperation between management and personnel, he added, pointing out that accident prevention is a major factor in obtaining and maintaining good working conditions and high productivity.

Chapter Chairman E. E. Hook, Dayton Oil Co., presided.

Candid views taken during dinner at Saginaw Valley chapter meeting, March 6. Left—Zigmond Madacey, Caterpillar Tractor Co., Peoria, Ill., chapter guest speaker.

Philadelphia

H. V. Witherington
H. W. Butterworth & Sons Co.
Chapter Director

Dr. G. H. Clamer, Ajax Metal Co., Philadelphia, was host to Philadelphia A.F.A. chapter March 14, when the group held its annual meeting at Franklin Institute.

Chapter directors met for a brief business session prior to the dinner. Speaker of the evening was Daniel Mannix, author, lecturer and falconer, who presented color motion pictures on the training and feats of his hunting eagle.

Detroit

C. J. Rittinger
American Car & Foundry Co.
Chapter Reporter

The technical program of the 51st Annual Convention of A.F.A. was outlined to members and guests of the host Detroit chapter by A.F.A. Vice-President Max Kuniansky, nominee for President in 1947-48, and Secretary-Treasurer W. W. Maloney, who were feted on the group's National Officers Night program at Rackham Memorial, March 19.

Technical sessions of the Convention, declared Mr. Kuniansky, will present a cross-sectional picture of latest developments in the castings field. He stressed the role of the Association in contributing to the progress of the industry in many of its ramifications.

Sand Treated

Chemically treated sand was the technical session topic, with presentation in the nature of a progress report. Mr. Kuniansky and T. J. Curry, metallurgist, Lynchburg Foundry Co., were speakers.

The treated sand, coated with an almost pure carbon resin, is now being used in the molding of from 200 to 250 tons of castings per day, Mr. Kuniansky revealed. These vary in section from $\frac{1}{8}$ to or 5 inches and are produced without such problems as buckling, scabs or "burned on" sand, the speakers reported. Cleaning time has been reduced approximately 50 per cent through reduction of the amount of sand adhering to the castings; mulling time has been substantially reduced, and shakeout is easy of accomplishment, since the sand disintegrates readily, the speakers told the foundrymen.

Officers and directors of the Philadelphia chapter stand before the statue of Benjamin Franklin in the Franklin Institute where meeting was held.

Permeability of the molding mixture is of less importance than is usually the case, since moisture content of the chemically treated sand can be reduced to from 3.3 to 3.5 per cent, as compared with the 5 per cent limit with sand previously utilized, the report continued. Messrs. Kuniansky and Curry stated that the sand has exhibited excellent flowability, lending it to the production of deep draws and patterns having vertical walls.

Chapter Chairman A. H. Allen, Penton Publishing Co., Detroit, presided at the dinner, and introduced the speakers.

Detroit Management Luncheon

Foundry management, through participation in the educational-technological programs of American Foundrymen's Association, can offer inspiration to all foundrymen, A.F.A. Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., told Detroit-area foundry officials March 20 at a Detroit chapter sponsored luncheon in Rackham Educational Memorial. Mr. Kuniansky and A.F.A. Secretary-Treasurer W. W. Maloney met with castings industry executives, including heads of the automotive industry and its foundries, and discussed current subjects.

Development of men for top foundry positions in castings firms is a "must," Mr. Kuniansky pointed out. The need is to "raise men, rather than merely let them grow"; and the Association, by educating foundrymen in the technology of

their field and providing them with opportunity to demonstrate leadership and develop organizational skill in cooperative A.F.A. activities, assists vitally in the selection and training of future industry heads, he said.

Importance of Industry

Foundries and their management should emphasize the community and national importance of the castings industry, the A.F.A. Vice-President commented. Pointing to the great technological progress of the field over the past 25 years and citing extension of foundry mechanization and application of new processes, Mr. Kuniansky urged that the advancements of the industry be made evident to everyone.

Participation in the technical activities of A.F.A. demonstrate the progressive spirit of the industry, he pointed out.

Where management has evinced an interest in A.F.A., its workers have been active in the Association —to their, and their firm's benefit, Secretary-Treasurer Maloney asserted. The man who knows his job does it better, he emphasized.

He described the Association as a cooperative technical society, in which self-help is the basic aspect and members act on a sense of obligation to the field and to themselves to raise the technological level of the industry.

Technical activities of A.F.A., he pointed out, are directed not only to foundrymen, but also to students in engineering colleges, trade and high schools and to the general public.

He outlined the technical program of the 51st Annual Convention, in Detroit, April 28-May 1, noting the broad range of foundry subjects, and said that registration is expected to set an all-time high for a non-exhibit year.

Interest World Wide

Interest of foundrymen throughout the world in the technical sessions of the Convention, he said, is indicative of the ever widening appreciation of A.F.A. activities.

A.F.A. National Director F. J. Walls, International Nickel Co., Detroit, introduced Mr. Kuniansky and Mr. Maloney to management representatives. Guests included:

J. D. Christian, president, and W. Christian, Jr., vice-president, Acme Foundry Co.; H. B. Updegraff, district manager, Aluminum Co. of America; W. B. Crawford, president, and L. G. Korte, engineer, Atlas Foundry Co.; C. A. Raftrey, works manager, and J. E. Bunch, foundry superintendent, Cadillac Motor Car Div., General Motors Corp.; Charles Carolin, president, R. B. Carolin Foundry & Machine Co.; A.F.A. National Director James H. Smith, general manager, Central Foundry Div., General Motors Corp.; Arnold Lenz, general manager, Chevrolet Motor Div., General Motors Corp.; E. A. Peterson, foundry manager, Chrysler Corp.; E. A. Rutt, plant superintendent, and Norman Gassman, assistant plant superintendent, Commerce Pattern Foundry & Machine Co.; J. M. Duncan, president, Detroit Steel Casting Co.; A. J. Smith, president, Enterprise Foundry Co.; B. D. Kunkle, vice-president in charge of engineering, General Motors Corp.; E. D. Flintermann, president, Michigan Steel Casting Co.; G. T. Christopher, president, Packard Motor Car Co.; S. W. Ostrander, manufacturing manager, Pontiac Motor Div., General Motors Corp.; L. C. Smith, Jr., personnel manager, Roberts Brass Mfg. Co.; C. A. Trombly, secretary, Sherwood Brass Corp.; S. G. Lakin, president, Stuart Foundry Co.; B. F. Emrick, plant superintendent, U. S. Radiator Co.;

L. E. Roby, president, Peoria Malleable Castings Co., Peoria (left) and R. A. Clark, Electro Metallurgical Co., Chicago, talking shop at the March 3 meeting of the Central Illinois chapter.

Photos of two groups from the foundry office, Caterpillar Tractor Co., Peoria, at the March 3 meeting held in Hotel Jefferson.

CHAPTER MEETINGS

APRIL - MAY

APRIL 13

TWIN CITY

Curtis Hotel, Minneapolis

A. F. Pfeiffer
Allis-Chalmers Mfg. Co.
Casting Dimensional Control

APRIL 17

CANTON DISTRICT

Yant's Cottage, Canton, Ohio

Nathan Janco
Centrifugal Casting Machine Co.
Centrifugal Castings

OREGON

Heathman Hotel, Portland

Harry Czyzewski
Metallurgical Engineers, Inc.
Modern Foundry Research and Development

APRIL 18

WASHINGTON

Gowman Hotel, Seattle

Die Casting

APRIL 19

SOUTHERN CALIFORNIA

Lakewood Country Club, Los Angeles

Ladies' Night

APRIL 21

NORTHWESTERN PENNSYLVANIA

Masonic Temple, Erie

National Officers and Old Timer's Night

CENTRAL OHIO

Chittenden Hotel, Columbus

C. E. Sims
Tom Barlow
Battelle Memorial Institute
Porosity and Gases
Inoculation

QUAD-CITY

Fort Armstrong Hotel, Rock Island, Ill.

R. G. McElwee
Vanadium Corp. of America
Cupola Operations with Material Shortages

APRIL 22

ROCKY MOUNTAIN EMPIRE

Oxford Hotel, Denver

R. O. Anderson
Norton Co.
Grinding Wheels in the Foundry Industry

APRIL 25

CHESAPEAKE

Engineers Club, Baltimore

C. A. Brashares
Harbison-Walker Refractories Co.
Refractories

MAY 1

SAGINAW VALLEY

Fischer's Hotel, Frankenmuth, Mich.

R. Heintz
Jack & Heintz Co.
Die Casting

MAY 5

METROPOLITAN

Essex House, Newark, N.J.

L. F. Tucker
City Pattern Works
Cooperation Between Patternmaker and Foundry

CENTRAL ILLINOIS

Jefferson Hotel, Peoria

B. C. Yearley
National Malleable & Steel Castings Co.
Highlights of Malleable Practice

MAY 7

SOUTHERN CALIFORNIA

Roger Young Auditorium, Los Angeles

Tom Barlow
Battelle Memorial Institute
Cupola Practice

MAY 8

NORTHEASTERN OHIO

Cleveland Club

Old Timer's Night

ST. LOUIS DISTRICT

York Hotel, St. Louis

J. L. Yates
National Engineering Co.
Engineering as it Effects the Foundry
National Officers Night

MAY 9

ONTARIO

Royal York Hotel, Toronto

Annual Meeting

PHILADELPHIA

Engineer's Club

R. F. Harrington
A. S. Wright
Hunt-Spiller Mfg. Corp.
Synthetic vs. Natural Sand for Cast Iron

EASTERN CANADA-NEWFOUNDLAND

Mount Royal Hotel, Montreal

Annual Meeting

MAY 12

CINCINNATI DISTRICT

Engineering Society Headquarters

F. G. Sefing
International Nickel Co.
Cupola Practice

MAY 13

ROCHESTER

Seneca Hotel

A. S. Phelps
Pratt & Letchworth Co.
Plant Housekeeping

MAY 15

DETROIT

Rackham Educational Memorial

Elmer Blake
Osborn Mfg. Co.
Characteristics of Molding Machines

R. L. Orth
American Wheelabrator & Equipment Corp.
Abrasive Cleaning of Castings

MAY 23

TEXAS

Rice Hotel, Houston

V. J. Sedlon
Master Pattern Co.
Permanent Molds

CHESAPEAKE

Engineers Club, Baltimore

Foundry Equipment

MAY 26

CENTRAL OHIO

Chittenden Hotel, Columbus

Pat Dwyer
Penton Publishing Co.
Heading and Gating

CENTRAL INDIANA

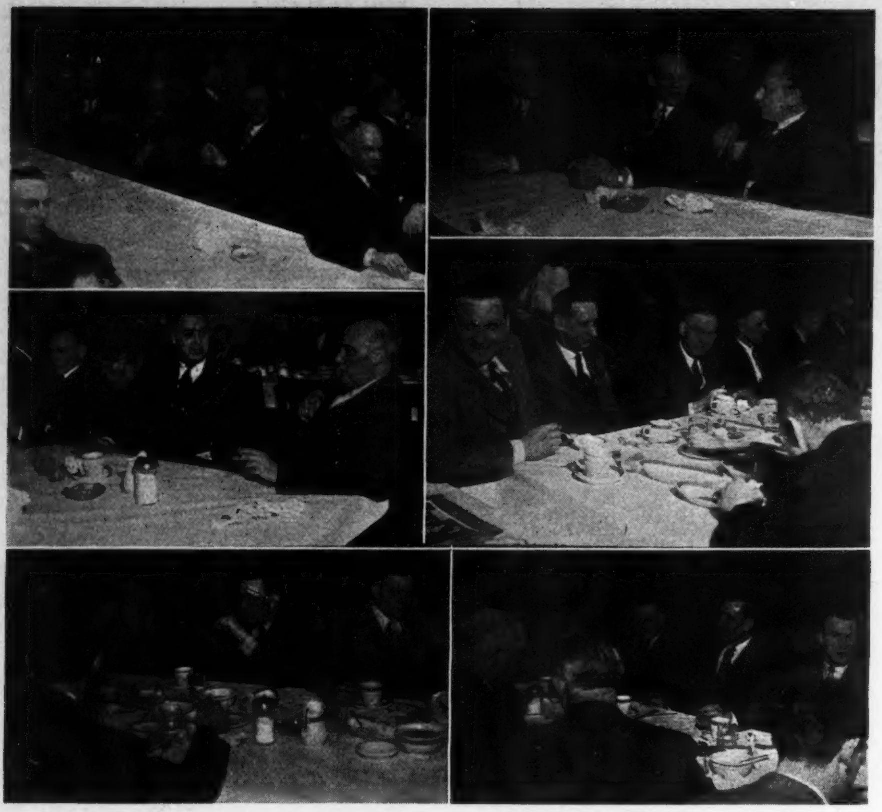
Athenaeum, Indianapolis

J. A. Gitzen
Delta Oil Products Co.
Corebinders and Corewashes

NORTHWESTERN PENNSYLVANIA

Moose Club, Erie

R. G. McElwee
Vanadium Corp. of America
Operating a Cupola under Material Difficulties



Dinner hour at the Saginaw Valley chapter meeting held February 6.

W. O. Leonard, president, Wilson Foundry Co., and officers and directors of Detroit A.F.A. chapter.

Central Illinois

G. H. Rockwell
Caterpillar Tractor Co.
Chapter Secretary-Treasurer

RALPH A. CLARK, metallurgist, Electro Metallurgical Co., Chicago, was guest speaker at the March 3 meeting of the Central Illinois chapter held in the Hotel Jefferson. Linking together such important items as cupola diameter, height of bed, coke sizes and stock height, the speaker covered the "Principles of Cupola Operation" rather thoroughly. He stressed that good supervision and conscientious charging crews were important to proper cupola practice. Slides graphically presented the results of proper and improper cupola practices.

Canton District

N. E. Moore
Wadsworth Testing Laboratory
Chapter Reporter

FOUNDRY PROBLEMS were handled by a "board of experts," comprised of chapter members, for the Quiz Night program of Canton District A.F.A. chapter, March 20.

H. G. Stevener, American Steel Foundries, Inc., Alliance; Charles Reyman, Atlantic Foundry, Barberton; G. M. Biggert, United Engineering & Foundry Co.; E. R. Daugherty, Stark Pattern Co., and M. G. Winters, Winters Foundry & Machine Co., all of Canton, and Chapter Secretary C. B. Williams, Massillon Steel Castings Co., Massillon, made up the panel.

The "experts" presented recommendations on difficulties encountered in practice by various chapter members, and described in written questions submitted in advance of the meeting, and then responded to discussion and questions from the floor. Participation was informal and general, and the more than 100 foundrymen present considered the technical session one of the most valuable.

Chapter Vice-Chairman C. F. Bunting, Pitcairn Co., Barberton, was presiding officer. C. E. Shaw, American Steel Foundries, Inc., chairman of the chapter nominating committee, presented that group's recommendations for officers and directors for 1947-48.

AFA CONVENTION HEADQUARTERS

Throughout the Detroit Convention, A.F.A. will maintain headquarters at both the Statler and Book-Cadillac Hotels, where Officers and Directors of the Association can be located during the week by their friends in the industry. Authors and session chairmen may make their between-meeting headquarters at the official A.F.A. offices, at their convenience. Press headquarters also will be located here.

Central Indiana

Jack W. Giddens
International Harvester Co.
Chapter Reporter

"CASTINGS OF ANY kind are controlled by variables and the purpose of metallurgical research is to help us control these variables," declared V. A. Crosby, metallurgist, Climax Molybdenum Co., Detroit, in addressing the March meeting of the Central Indiana chapter.

In a diagnosis of "Factors Affecting the Physical Properties of Gray Iron," Mr. Crosby discussed classification of properties to be considered, constitutional make-up of gray iron, influence of the prior structure of raw material, and the effects of thermal treatment of liquid iron, graphite pattern, alloying elements and heat treatment.

Photo slides were used to show how cast iron may be affected and also to illustrate the relationship of matrix structure and strength. The pictures evidenced how a finely divided graphite formation, widely scattered throughout the casting, will cause weakness. If the graphite is in "strings," however, the casting will be strong, and malleable.

Low carbon cast iron will give higher tensile, higher transverse strength, higher Brinell hardness number and the same deflection as that of a somewhat higher carbon cast iron, Mr. Crosby declared.

The strength of a finished casting, he added, may be improved by the use of late additions of silicon or by an increase in superheat.

A joint meeting of the Central Indiana chapter and Electric Steel Castings Co., Indianapolis, was held

(Continued on Page 178)

COMMITTEE MEETING SCHEDULE During A.F.A. Convention in Detroit

Monday, April 28

10:00 AM—Deformation Committee, Sand Division
10:00 AM—Educational Division Business Meeting
4:00 PM—Core Test Committee, Sand Division
4:00 PM—Precision Investment Casting Committee
8:00 PM—Subcommittee on Core Washes and Pastes, Core Test Committee, Sand Division
8:00 PM—Aluminum and Magnesium Division Business Meeting

Tuesday, April 29

9:00 AM—Nominating Committee, Steel Division
9:00 AM—Controlled Annealing Committee, Malleable Division
10:00 AM—A.F.A. Executive Committee Meeting Luncheon
10:00 AM—Refractories Committee
10:00 AM—Youth Encouragement Committee, Educational Division
10:00 AM—Foreman Training Subcommittee, Industrial Training Committee, Educational Division
10:00 AM—Chill Test Committee, Gray Iron Division
10:00 AM—Committee on Heat Treatment of Cast Iron
10:00 AM—Cupola Research Committee, Gray Iron Division
2:00 PM—A.F.A. Board of Directors' Meeting
2:00 PM—Alloy Recommendation Committee, Aluminum and Magnesium Division
2:00 PM—Malleable Division Business Meeeting
2:00 PM—Apprentice Training Committee, Educational Division
2:00 PM—Pattern Division Business Meeting
2:30 PM—Committee on Test Bars, Aluminum and Magnesium Division
4:00 PM—Committee on Centrifugal Casting, Aluminum and Magnesium Division
4:00 PM—Reclamation and Alloying Committee, Aluminum and Magnesium Division
4:00 PM—Shrinkage and Porosity Committee, Aluminum and Magnesium Division
4:00 PM—Fluidity Committee
4:00 PM—Research Committee, Malleable Division
4:00 PM—Sand Division Business Meeting
8:00 PM—Sand Casting Committee, Aluminum and Magnesium Division
8:00 PM—Research Committee, Brass and Bronze Division
8:00 PM—Flowability Committee, Sand Division

Wednesday, April 30

9:00 AM—Annual Lecture Committee
9:00 AM—Heat Transfer Committee
9:00 AM—Brass and Bronze Program and Papers Committee
9:00 AM—Microstructure of Cast Iron Committee, Gray Iron Division
9:00 AM—Sand Shop Operation Course, Sand Division
10:00 AM—Pattern Manual Committee
10:00 AM—Brass and Bronze Division Business Meeting
12:00 PM—Green Sand Properties Committee, Sand Division
2:00 PM—Foundry Talks Subcommittee, Engineering Schools Committee, Educational Division
5:00 PM—Committee on Physical Properties of Steel Foundry Sands at Elevated Temperatures, Sand Division
5:00 PM—Test Bar Design Committee, Gray Iron Division
8:00 PM—Committee on Analysis of Casting Defects, Gray Iron Division
8:00 PM—Mold Surface Committee, Sand Division
8:00 PM—Committee on Physical Properties of Iron Foundry Molding Materials at Elevated Temperatures, Sand Division
8:00 PM—Steel Division Business Meeting

Thursday, May 1

9:00 AM—Steel Program and Papers Committee
9:00 AM—Foundry Cost Committee
4:00 PM—Gray Iron Division Business Meeting

Appoint Four Groups on Aluminum—Magnesium

APPOINTMENTS to four 1947 A.F.A. Aluminum and Magnesium Division committees have been announced. The committees and appointments are:

Program and Papers—W. E. Martin, National Smelting Co., Cleveland, *Chairman;* Oscar Blohm, Triangle Foundry Co., Chicago; Dr. L. W. Eastwood, Battelle Memorial Institute, Columbus; A. W. Stolzenburg, Aluminum Co. of America, Cleveland, and Dr. Robert Thomson, International Nickel Co., Detroit.

Reclamation and Alloying—Walter Bonsack, National Smelting Co., Cleveland, *Chairman;* E. J. Basch and J. C. Fox, Doehler-Jarvis Corp., New York City; M. E. Brooks, Dowmetal Foundry, Dow Chemical Co., Bay City, Mich.; Charles Cooper, Acme Aluminum Alloys, Inc., Dayton; F. J. Francis, Metals and Alloys, Leaside, Ont.; W. H. Gunselman, Samuel Greenfield Co., Buffalo; R. A. Quadt, Federated Metals Div., American Smelting & Refining Co., Perth Amboy, N. J.; A. Sugar, American Metal Co., New York, and H. R. Youngkrantz, Apex Smelting Co., Chicago.

Shrinkage and Porosity—J. C. DeHaven, Battelle Memorial Institute, Columbus, *Chairman;* Walter Bonsack; D. L. W. Eastwood; C. E. Nelson, Dow Chemical Co., Midland, Mich., and W. E. Sicha, Aluminum Co. of America, Cleveland.

Test Bars—David Basch, technical representative, Almin Ltd. of Great Britain, Schenectady, *Chairman;* E. J. Basch; Walter Bonsack; M. E. Brooks; Dr. Blake M. Loring, Naval Research Laboratory, Washing, D. C.; J. W. Meier, Canadian Bureau of Mines, Ottawa, Ont.; H. J. Rowe, Aluminum Co. of America, Pittsburgh, and T. D. Stay, Reynolds Metals Co., Cleveland.

Release Standards List

STANDARDS concerning every important engineering field and including many developed under war procedure and now approved for peacetime use, are among those in the revised list of 864 American Standards, now available for general distribution, P. G. Agnew, vice-president, American Standards Association, has announced.

The list is offered without charge to interested trade, technical and governmental bodies, Mr. Agnew pointed out, and represents the efforts of some 3,000 men, associated with 660 organizations working on the developments of standards for industry.

Beg Your Pardon

In the list of A.F.A. Committee Appointments in the March issue of AMERICAN FOUNDRYMAN, the name of D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., should have appeared as Chairman of the Flowability Committee. By error, P. E. Kyle, Cornell University, Ithaca, was listed in the post.

LOOKING AHEAD

[CONTINUED FROM PAGE 81]

should look for men who wish to learn and who will, therefore, have a pride of accomplishment in becoming competent in various departments. The improvements gradually being made by all foundries have greatly improved them as work places.

The industry should not rest content because there is, at present, an over-demand for its products. Users and potential users must have castings if they are to continue as consumers. The industry should make every possible effort, then, to provide all who need malleable castings with at least a minimum supply at this time and until it is to meet all demands.

PRECISION INVESTMENT CASTING

By Robert Neiman

Chairman, A.F.A. Precision Investment Casting Committee. Director of Research, Whip-Mix Corp., Louisville, Ky.

PRECISION INVESTMENT casting, at once the foundry industry's oldest and newest process, came into general use during World War II and thus has attained industrial importance only within the past five years. It is not a true competitor of other foundry processes; it is a foundry technique that handles small, intricate parts requiring accuracies to within tolerances of a few thousandths and surfaces of high-degree smoothness. It eliminates most machining operations and handles alloys that defy economical cutting or forming by any other known and practical means.

Robert Neiman

Since its widespread adoption was war-born, the process was newly applied under abnormal conditions. Production, and quick production, was the goal; economy was a secondary consideration. Nevertheless, results in general were excellent. On V-J Day, however, most precision founders were in a peculiar and difficult position; their products were war materials, and few had pre-war customers or parts to return to. Some were forced out of business; only the more experienced and financially sound were able to convert to peacetime production. Progress was not rapid; new customers and products were required and a new philosophy of economical production had to be instilled. The fact that a good percentage of the wartime firms engaged in precision investment casting survived reconversion is indicative of the benefits to be gained from the process and an omen of a successful future for this branch of the industry.

A major current problem is education of the customer and his design engineers in proper applications of precision castings. Unfortunately, there is no simple rule governing the choice of a precision cast part. As a result, producers must analyze and quote on many inquiries, the majority calling for parts that can be made much more economically by other methods. The prospective purchaser often gets an unfair introduction to the possibilities of precision cast parts. Usually, however, a meeting between the engineering departments of the customer and producer solves the puzzling questions, and often improved designs lead to greater efficiency at lower cost.

The industry's problems are not all external. The internal ills include the usual foundry problems. Molten metals must be handled and, as someone has said, "Molten metal is boss in the foundry."

Dimensional accuracy of 0.003-in. per in., sometimes lower, and surface finish measured in micro-inches require vigilant control and constant testing of the highest order. Improvements in wax patterns, investments, and mechanized production methods are constantly sought. Perfection of casting apparatus and methods are needed to reduce imperfections and rejections.

Reduced costs through research and development of better products and processes, along with more experience and "know how" to lessen the number of test runs to ascertain shrinkages on each job, will gradually widen the field. Along with this will come a better and more accurate method of cost accounting.

Ages old, precision investment casting is still a young process, inexperienced in some ways but not afraid of those small intricate parts so difficult to handle by other casting methods. The process will gradually mature and become capable of handling larger, even though less intricate parts, achieving for them dimensional accuracy and smoothness.

ANNUAL BUSINESS MEETING FEATURES

FOUNDRYMEN who attend the Annual Business Meeting of the A.F.A., Wednesday afternoon, April 30, during the Detroit Convention, will be rewarded by a program of special interest. The meeting will convene at 2:00 p.m. at the Book Cadillac Hotel and there will be no other sessions at that time.

President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, will present the President's Annual Address.

Because of the growing emphasis on education and training in the foundry industry, the presentation of awards in the National Apprentice Contests will be an outstanding feature of the session. All 1st prize winners willl be present to receive their awards.

Of particular interest to foundry management will be an announcement concerning the recently organized Foundry Educational Foundation, sponsored by the Gray Iron Founders Society, Malleable Founders Society, and A.F.A., as founding members.

Main feature of the meeting will be the presentation of the Charles Edgar Hoyt Annual Lecture by J. T. MacKenzie. The Annual Election of new Officers and Directors for A.F.A. will be announced during the Annual Business Meeting.

The annual business meeting will be open to all, members and non-members. Everyone attending the Detroit Convention is invited at attend.

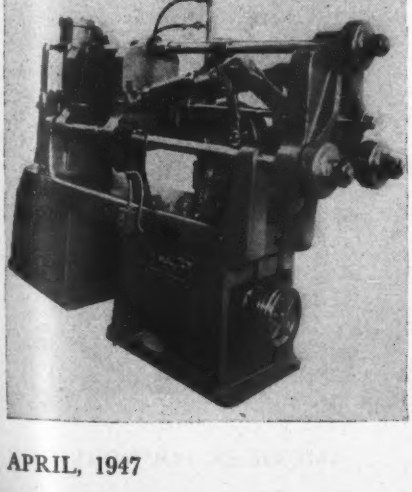
NEW PRODUCTS

Moisture Reader

Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, has developed the "No. 278 Moisture Teller," designed for quick, accurate determination of the moisture content of sand. Available for either 115 or 230-volt power supply, the unit dries average samples within two to three minutes. Precise moisture percentage reading is obtained by weighing the sample before and after drying. Heated air is driven through the sample and automatic temperature control, in the range 150 to 300°F, is provided.

Die Casting Machine

Light Metal Machinery, Inc., 736 Penton Bldg., Cleveland, introduces a new model of its automatic, high speed die casting machine for production of zinc, lead and tin castings. Shot capacity is 16 ounces, casting area is 30 square inches, and the unit has four fixed speeds, 240, 330, 520 and 720 shots per hour. Operator efficiency is said to have no effect on the production rate, once the cycling rate has been selected and set; operator merely fills the melting pot and lubricates the die. Floor space required is 100 square feet. Time for complete die change and set up is said to average 15 minutes; replacement of pressure pot assembly, 30 minutes; bolster plate bearing sleeves, less than one hour.

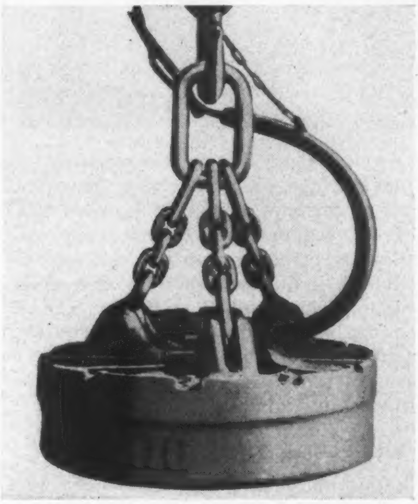


Melting Pot

Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, has developed a new melting pot for aluminum and white metal. Normalized to prevent cracking, this pot is a heavy type suitable for pouring as well as melting. It is cast from a special alloy for which a life of 200 heats is claimed. Capacity is 50 pounds.

Magnet Chain

S. G. Taylor Chain Co., Hammond, Ind., announced a new triple magnet chain, designed for longer life and extra safety. Wear from gouging and kinking is said to be minimized by use of a 60-degree twist in two of the three connecting links. For extra safety, a special analysis steel is used, one said to possess 100 per cent greater tensile strength than low-carbon steel or wrought iron and which, by superior resistance to shock, work hardening and grain growth, eliminates the need for periodic heat treatment.

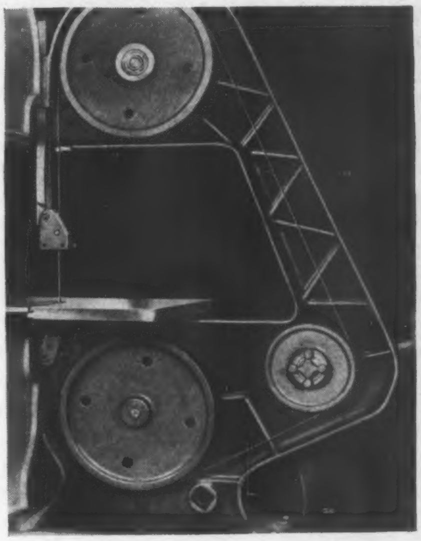


Sliding Table

Leo G. Brown Engineering Co., 1127 Riverside Drive, Los Angeles 31, recently introduced a sliding table for quick mounting to any drill press. Top, 7½ in. square and 3¾ in. high, is fitted for 1-in. T-bolt heads. Travel is 5 in. in each direction; and total weight is 24 pounds.

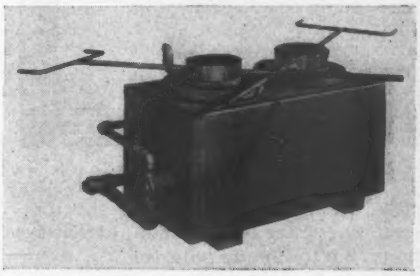
Band Saw

Ermac Co., 5531 S. Vermont Ave., Los Angeles 37, offers a new 12-speed, 85 to 1750 feet per minute, band saw, said to be suitable for sawing wood, plastic, aluminum, cold rolled steel, angle iron, tool steel or cast iron. Unit is designed to eliminate the possibility of injury through breakage of the blade. All wearing parts are of cast iron; covers, pulleys and wheels, of cast aluminum. Overall height is 72 in; width, 38 in; breadth, 20 in, and capacity of throat (blade to frame) is 17½ in. Strongly-braced frame is cast iron, as is the table, which tilts to 45 degrees for angle sawing, by turn of adjustment screw.



Aluminum Melting Furnace

Kindt-Collins Co., 12651 Elmwood Ave., Cleveland, announces a new aluminum melting furnace for medium requirements in moderate production by pattern shops, schools, small foundries and other plants. The firm lists several advantages of the unit: metal can be melted and poured directly from the melting pot, which is claimed to withstand more than 100 heats with reasonable care; simple fuel and air adjustments; efficient insulation to insure maximum heat; pilot equipment for quick, easy starting; quick melting, with low fuel consumption; adaptable for occasional melting of brass. The "Master" furnace can be oil or gas fired; is available in single units, 50-lb capacity, or double units, 100-lb capacity.



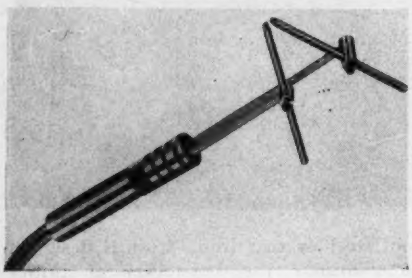
Marking Device

Jas. H. Mathews & Co., 3901 Forbes St., Pittsburgh 13, Pa., is offering a new mark-

ing device, recommended for printing name of manufacturer, trademark, grade or specification. Adjustable rolls guide the unit during marking. Device has interchangeable rubber dies and an adjustable blade in the ink fountain affords uniform distribution of ink over printing roll surface. No pressure is necessary. The hand operated model may be mounted in a fixed position by removing handles.

Welding Torch

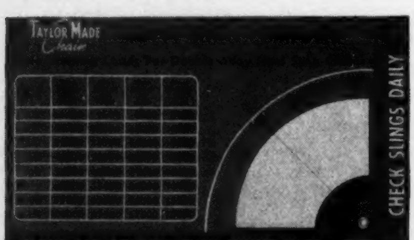
Cesco Products, Inc., 30 N. La Salle St., Chicago 2, announces its new "Lite-ning Arc Torch" for use with either AC or DC equipment. Two models are available, one for ¼-in carbons, the other for ⅜-in carbons. Features include an automatic arc, designed to simplify welding proce-



dure; and thumb control adjustment of the arc. Advantages claimed by the manufacturer include: soft, intense heat with no pressure blow or oxides as a characteristic of the carbon arc flame produced; low cost; applicability to welding of aluminum and virtually all other non-ferrous metals, as well as brazing, soldering, preheating and surface hardening of materials.

Safe Load Computer

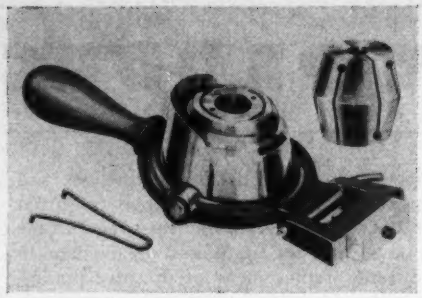
S. G. Taylor Chain Co., Hammond, Ind., offers without charge to all sling chain users the "Safety Sling" computer, designed to give hookers an accurate yardstick with which to determine the maximum safe load that a sling chain



can lift at any given angle. The hooker sights through the window of the computer on one leg of the chain, then moves the needle to line up with the leg. Angle of the chain is read at the end of the needle; and safe working load, on a scale on the opposite side of the computer.

Collet Chuck

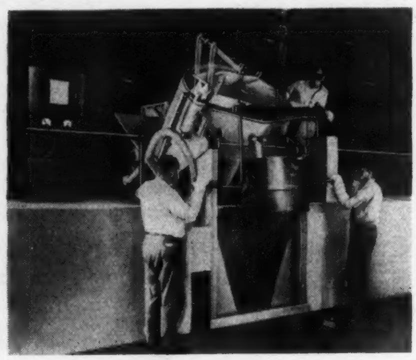
Micro Parts Co., 322½ East Beach Ave., Inglewood, Calif., is in large scale production with its new "Miracle Collet Chuck," adaptable to any standard bench lathe. The unit can be used with stock up to one inch; and is said to require no lubrication. Locks and unlocks with



throw of a lever; revolves on the spindle; is designed to be removed easily and quickly. Collets are available in round, hex or square.

Induction Melting Furnace

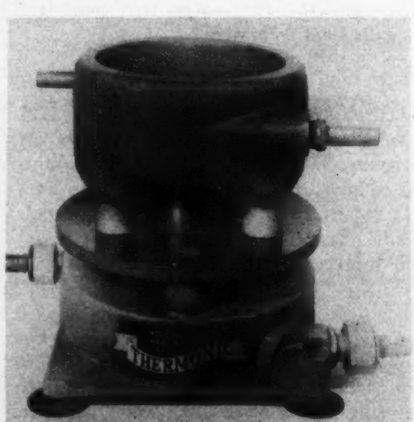
Ajax Engineering Corp., Trenton, N. J., presents a new 125-kw induction melting furnace for aluminum and its alloys.



Especially designed for the melting of finely divided aluminum alloy particles, such as turnings, chips and unbaled foil, the furnace operates on the twin coil induction principle; can be connected to standard frequency power line; and is said to yield as much as 96 per cent of the dry weight of the metal. Pouring spout is located in line with axis of furnace, permitting easy adaptation to pouring into molds.

Induction Heating Accessory

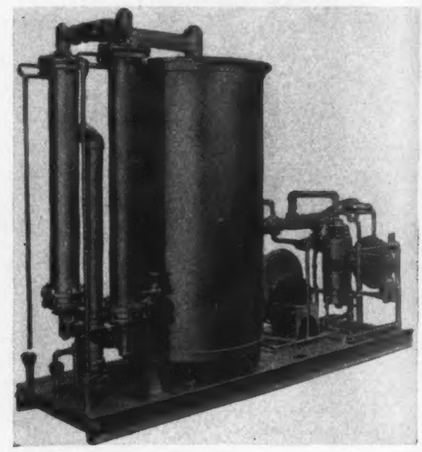
Induction Heating Corp., 389 LaFayette St., New York 3, has developed a compact, hydraulic rotary spindle and quench ring, combined in a single unit, designed to simplify the handling and heat treatment of parts requiring rotation during the heating cycle and subsequent quenching in position. Flexibility in the unit,



which is known as the "Thermonic," is achieved by interchangeable quench rings and adaptors; it is portable and intended for use with any type of induction heating equipment, yet may be bolted down for long run jobs; and the speed of rotation of the spindle, actuated by a water driven turbine fed through standard hose and nozzle attachments at the base of the unit, may be regulated by variation in the flow of the water.

Atmosphere Producer

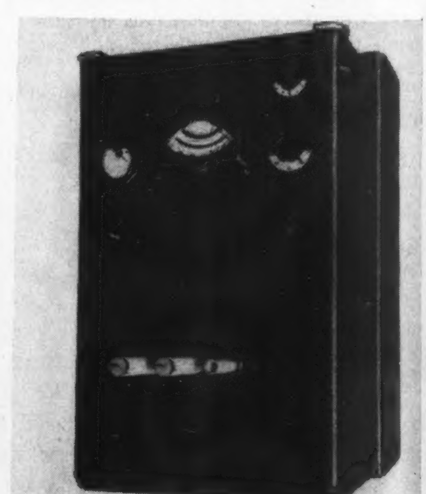
Vapofier Corp., 10316 S. Throop St., Chicago 43, has announced the application of its "Vapofier" gas generating unit as a



producer of firing atmosphere for electric furnaces. Fuel oil is utilized to generate a gas burned in the combustion chamber unit. The products of combustion are delivered to the furnace, after removal of water vapor. Flame quality may be varied from oxidizing to reducing; and fuel-air ratio predetermined and maintained without change in manifold pressure, it is claimed.

Laboratory Furnace

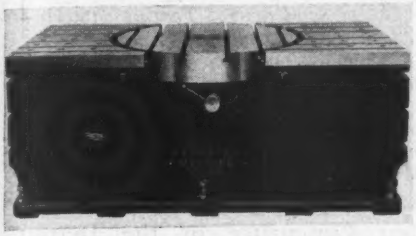
Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, has designed a new industrial laboratory combustion furnace, "Hi-temp Furnace," which features simplicity of operation, maximum temperature of 2900°F and low maintenance. Comes as an integral unit, complete with power supply,



ammeter, selection switches, heating elements, automatic temperature control and thermocouple, and can be connected to any 220-volt outlet.

Indexing Table

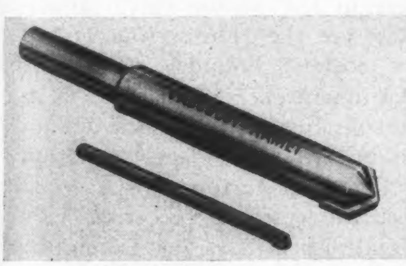
Kaukauna Machine Corp., Kaukauna, Wis., offers its Model 700 indexing table made to support heavy work pieces without deflection. Originally designed for use with portable drilling and tapping machines, it is adaptable to other machining



operations and to inspection or layout work. Overall dimensions: length, 72; width, 36¼; and height, 29 inches. Main bed is of iron, with T-slots in top and ends for clamping purposes. Has an indexing platen in the center, which is also equipped with T-slots for clamping. Platen is held firmly in position with adjustable shoe clamps. Set-up may be made at one end of table; work is completed at the other.

Carbide-Tipped Drills

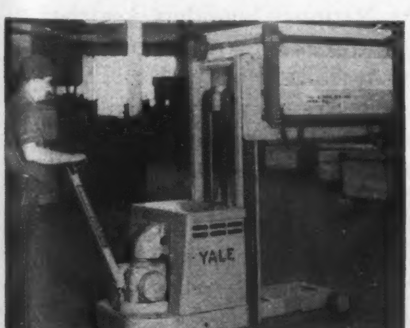
Vascoloy-Ramet Corp., North Chicago, Ill., is offering a new line of carbide-tipped masonry drills, available in off-set and straight shank designs and in diameters of



.198 to 1.535. Adaptable to any rotary powered or hand drill, the tips are said to reduce drill wear, drilling time and percussion hammering.

Power Hand Truck

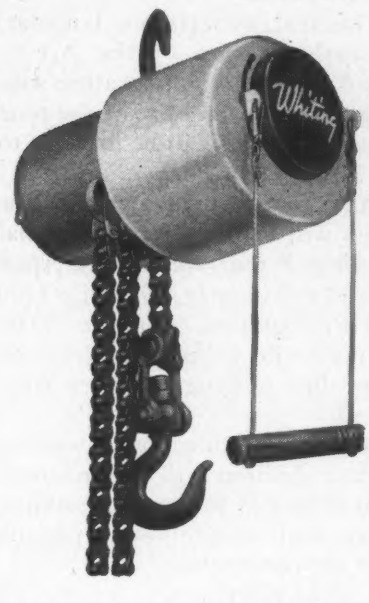
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, has introduced a new variation of the "worksaver" type of powered



hand truck, the "Yale High-Lift Platform Model Worksaver." It is available in two models, one with platform to go under a 7-in. skid, and lifting to a height of 66½ inches; the other, to go under an 11-in. skid, lifting to 70½ inches. Both have a capacity of 4,000 pounds. Features include short turning radius; independent motors for lifting and driving; automatic braking; finger control, and two forward and two reverse speeds.

Portable Electric Hoist

Whiting Corp., Harvey, Ill., has announced a new line of roller-chain electric hoists of one-quarter, one-half and one-ton capacities and light in weight, the one-ton model weighs 87 pounds, so



that units can be installed or moved by one man. An unusual feature of the hoist is that it can be operated in inverted position: the chain run to an overhead suspension point, the load attached directly to the hoist, which is turned upside down and will then "climb" the chain with the load. Control is exerted by the operator through a single-bar grip, which can be operated by one hand, leaving the other free to steady the load. A simple, double-reduction, totally enclosed, worm-gear drive is utilized, adding to compactness and light weight of the hoist.

Automatic Electrode

Wilson Welder & Metals Co., 60 East 42nd St., New York, has added to its line of manual electrodes "Una" automatic wires and tapes. Five knurled type wires and five flux-impregnated tapes make up the "Una" line. The automatic wires may be used separately or in conjunction with the tape, and are designed for flat position operation in varied assembly line applications. The firm also announces an improved, all-position electrode, No. 107, designed for work involving poor fit-up on mild steel and especially recommended for single or multiple pass welding on rusty or dirty plates or sections. The rod conforms to the E-6012 classification of the AWS specification A233-45T and is marked in accordance with NEMA standards. Outstanding benefits claimed for the rod are: it can be used with abnormally high welding current; has exceptionally high deposition rates; permits use of "dragging technique," and offers high burn-off rate.

Moisture Meter

J. Thos. Rhamstine, Harlingen, Texas, announces the "Foundry Sand Meter" for determination of moisture content of

foundry sands. The unit (similar in design to that shown in the photo) operates electrically. Readings are obtained by placing the "prod" in the sand. Once the meter is adjusted to the scale reading at which sand is to be held, no further controls or calculations are necessary. Testing procedure is simple and rapid—affording as many as fifteen readings per minute—and an accuracy rating within one-quarter percent.

Safety Equipment

Mine Safety Appliances Co., Pittsburgh, Pa., has introduced the "Speed-frame," self-adjusting welders' goggles set designed to eliminate the waste motion of hand adjustment. Goggles are raised or lowered by a nod of the head, an arrangement that leaves the hands free for work. Lightweight fiber headframe holds the goggles in either position, is adjustable in three directions through side and top straps, and is maintained in adjustment desired by a clamp.

Another new development of the firm is the "Oxygen Indicator Type C," for measuring the oxygen content of gaseous mixtures in metallurgical and other processes. Electrolytic detector cell of the unit consists of a plastic container with a hollow carbon tube and metallic plate serving as electrodes in approximately an ounce of liquid electrolyte. Polarization in the cell causes hydrogen to be deposited on the carbon pole. When a gas sample containing oxygen is passed through the hollow carbon electrode, diffusion of the oxygen through the porous carbon results in its combination with "electrolytic hydrogen" and in consequent effect upon the voltage output of the cell. Presence of oxygen is indicated on a direct reading, linear scale meter.

APPRENTICE CONTEST INTEREST

Runs High as Educational Work Expands

ENTRIES IN THE A.F.A. National Apprentice Contests indicate that competition in 1947 will be the keenest in years. According to word from the Apprentice Contest Subcommittee of the A.F.A. Educational Division, the return of veterans and reorganization of many apprentice training courses have imparted new life to the contests.

First held at the Milwaukee Convention in 1924, additional companies have been represented in the entries each succeeding year.

The contest for the Castings Sections this year closed April 14, and the Patternmaking Section will close April 17. For the first time, it is intended that all contest castings be radiographed. This arrangement was made possible through the courtesy of Ford Motor Co., at whose plant all entries will be judged.

April 18 has been set for the final judging of entries, a much earlier date than formerly. This will give time for bringing the 1st prize winners in each contest to the Convention in Detroit. Plans are being made for the National President of A.F.A., S. V. Wood, to formally present the prizes.

Names of the men who will act as judges of the various apprentice contests are as follows:

Non-Ferrous Division

A. Di Giulio, consulting metallurgist, Detroit.

H. A. Kelly, Sales Manager, City Pattern Foundry & Machine Co., Detroit.

Gray Iron Division

R. G. McElwee, Detroit Manager, Vanadium Corp. of America, Detroit.

W. B. McFerrin, Metallurgical Engineer, Electro Metallurgical Co., Detroit.

E. E. Woodliff, Engineer, Foundry Sand Service Engineering Co., Detroit.

Steel Division

L. V. Savage, Works Manager, Detroit Steel Casting Co., Detroit.

Harold Schroeder, Works Manager, Michigan Steel Casting Co., Detroit.

George W. Allen, Monroe Steel Castings Co., Monroe, Mich.

Patternmaking Division

John Campbell, Foundry Instructor, Cass Technical High School, Detroit.

J. M. Duncan, President, Detroit Steel Casting Co.

Otto Yahanka, Supervisor, Roberts Brass & Mfg. Co., West Dearborn.

This year, as was done last year, by authorization of the A.F.A. Board of Directors, apprentices winning first prize in each of the four contest divisions will be brought to the 51st Annual Convention in Detroit to receive their awards. The prizes will be given at the Annual Meeting, 2 pm, Wednesday, April 30, and will include a check for $100 and a recognition certificate. Prize winners will be notified by wire soon after judging has been completed.

Second and third prize winners of each division will be presented their checks of $50 and $25, respectively, and recognition certificates after the convention.

Practical Shop Course Sessions at Detroit

EVER SINCE the Shop Course sessions were initiated at A.F.A. Conventions some years ago, these events have drawn heavy attendance from practical foundry operators. They have proved especially popular among local plant men in each city where the Foundry Congress has been staged, and the 1947 Convention will offer eight separate shop courses. All will be conducted as off-the-record meetings with no reporter present.

This year's program includes a 4-session Gray Iron Shop Course and a 4-session Sand Shop Course covering a wide variety of practical subjects, as follows:

Gray Iron Shop Courses

(1) Mon., Apr. 28, 4 pm—*"Variables Affecting Carbon Control in Cupola Operation"*—Rackham Educational Memorial.

(2) Tues., Apr. 29, 8 pm—*"Effect of Coke Quality on Cupola Melting"* —Hotel Statler.

(3) Wed., Apr. 30, 8 pm—*"Factors Affecting Cost of Cupola Operation"* —Hotel Statler.

(4) Thurs., May 1, 2 pm—*"Variables Affecting Electric Furnace Gray Iron"*—Book-Cadillac Hotel.

Sand Shop Courses

(1) Mon., Apr. 28, 8 pm—*"Malleable Sand Problems"*—Hotel Statler.

(2) Tues., Apr. 29, 8 pm—*"Your Sand Pile"* (non-ferrous)—Book-Cadillac Hotel.

(3) Wed., Apr. 30, 8 pm—*"The Roll of Sand in Hot Tearing"* (Steel)—Book-Cadillac Hotel.

(4) Thurs., May 1, 4 pm—*"Variables in Gray Iron Sand Practice"*—Book-Cadillac Hotel.

Under the chairmanship of R. G. McElwee, Vanadium Corp. of America, the Shop Course Promotion Committee of the Detroit Chapter has been most active in spreading word of these shop courses among local plants. As a result, the attendance in Detroit at these sessions should be materially increased and facilities have been provided accordingly.

Foundry Groups to Meet at Convention

Several of the major foundry associations have announced their intention of holding meetings during the time of the A.F.A. Convention in the Motor City. Among these are the Non-Ferrous Founders Society, Foundry Equipment Manufacturers Association, Non-Ferrous Ingot Metal Institute, and the National Founders Association.

The Non-Ferrous Ingot Metal Institute will hold a meeting of the Metallurgists' Advisory Committee at the Statler Hotel on Thursday, May 1.

The Non-Ferrous Founders Society will hold its regular April meeting at the Fort Shelby Hotel on Sunday April 27, and Monday April 28, culminating in a dinner Monday evening.

The Administrative Council of the National Founders Association has scheduled a 2-day conference on April 28-29 at the Hotel Statler.

The Foundry Equipment Manufacturers Association expects to hold a number of meetings during the Convention, beginning with a Board meeting on April 29 at Hotel Statler. Meetings of the various Product Policy Groups of F.E.M.A. will also be held at the Statler Hotel on April 28 and 30.

FOUNDATION

(*Continued from Page 144*)

founding trade organizations. The remaining five, initially, will be selected by the first six. After the first year when membership in the organization has expanded, the five directors at large will be elected by the members. A.F.A. representatives, acting as directors of the Foundation, are B. D. Claffey of the Gray Iron & Aluminum Division, General Malleable Corp., Waukesha, Wis., and F. G. Sefing.

The Foundation estimates that the fund required to finance the broad educational effort for the first three years will total $280,000. Membership contributions will be solicited from all producers of malleable and gray iron castings and the sponsoring organizations hope the campaign will also receive the support of foundry equipment and supply manufacturers. Spokesmen for the new organization say the program contemplates the appointment of a full time executive secretary who will work with the Foundation's technical committee and with university faculty representatives in the development and improvement of foundry courses.

The Ferrous Foundry Education Committee, headed by Anthony Haswell, President, Dayton Malleable Iron Company, did the spade work leading to the formation of the new organization. Other members of the committee were John M. Price, President, Ferro Machine and Foundry Company and P. E. Rentschler, President, Hamilton Foundry and Machine Co.

Others active on this committee were R. W. Crannell, Vice President, Lehigh Foundries; Frank S. O'Neil, Vice President, Link-Belt Company; Professor P. E. Kyle, Cornell University; F. G. Sefing, International Nickel Company; S. C. Wasson, Manager, Chicago Works, National Malleable and Steel Castings Co.; A. C. Denison, President, Fulton Foundry and Machine Co.; H. A. Deane, Vice President, American Brake Shoe Company; W. M. Caldwell, Secretary, Gray Iron Founders' Society; H. F. Scobie, Educational Assistant, A.F.A. and J. H. Lansing, Consulting Engineer, Malleable Founders Society.

CHAPTER ACTIVITIES

(Continued from Page 164)

February 12. At this gathering De Loss Walker, nationally known speaker and former associate editor, *Liberty Magazine,* talked on "Our Future—Our Income."

The average individual, "living in a fool's paradise," is not worried about the future and is in a rut, Walker declared.

Canton District

N. E. Moore
Wadsworth Testing Laboratory
Chapter Reporter

MEETING FEBRUARY 20 at Yants Cottage, Canton, Ohio, members of the Canton District discussed requirements for a sound cylinder head casting and estimated the production cost of 50 such castings. Prior to the meeting a blueprint of the cylinder head had been mailed to each member for study. With both ferrous and non-ferrous foundrymen offering their views a lively discussion was stimulated.

A short address by Karl F. Schimdt, United Engineering & Foundry Co., Canton, covered apprentice training problems. He also urged foundries to be receptive to new production methods in order to increase efficiency and improve their products.

I. M. Emery, chapter chairman, Massillon Steel Casting Co., Massillon, Ohio, presided.

Mexico City

N. S. Covacevich
Casa Covacevich
Chapter Secretary

R. L. LEE, General Motors Corp., Detroit, addressed the February meeting of the Mexico City chapter as the official representative of the A.F.A.

Speaking in the language of Cervantes, Mr. Lee congratulated the members of the Mexican chapter on the progress they have made in A.F.A. work.

"Our Board of Directors have asked me to convey their sincere greetings," he said, "and to assure you that they feel honored in having each one of you as a member. Your chapter is an important section of the Association, which is international."

(Concluded on Page 180)


TURBO-SUPERCHARGER DIAPHRAM
MAIN COREBOX FOR TURBO-SUPERCHARGER COMPRISED OF 59 SEPARATE PIECES

CHAPTER ACTIVITIES

(Continued from Page 178)

Mr. Lee visited a number of foundries during his visit to Mexico City and was impressed with the high morale of the operators. "Even the most humble laborer did his work with full understanding of its importance, and his efforts were appreciated by his companions and his supervisor," he declared.

"I observed that the owner of one foundry, when speaking to the worker, considered him to be what he really is, a human being. This, to my way of thinking, is more important than all the technique and scientific knowledge combined."

While in Mexico City, Mr. Lee was the guest of Mr. Villalobas, president of Casa Covacevich, and Ingeniero Goicoechea, vice president of the company.

Twin City

A. A. Gustafson
E. F. Houghton & Co.
Chapter Reporter

AN EVENING given over to Old Timers featured the Twin City chapter meeting for March. Thirty-three celebrities of the Twin City area were treated royally as a record turnout paid them homage. They represented the accumulation of 1622 years experience in the foundry industry.

National Officers night was held in conjunction with the Old Timers party. S. C. Massari and H. F. Scobie were present as representatives of the National Offices.

National A.F.A. President S. V. Wood, Minneapolis Electric Steel Castings Co., spoke on the growth of the foundry industry, emphasizing the need for youth in the castings field. Young men should be encouraged to show ambition, pep and zeal for the industry, he said.

S. C. Massari, A.F.A. Technical Director, described the technical activities of the Association, and the tremendous amount of work and effort expended by various committees in preparing convention material.

H. F. Scobie, A.F.A. Educational Assistant, outlined the Association's educational program and described the activities of the American Foundrymen's Association Educational Division.

Combs GYRATORY FOUNDRY RIDDLES

TYPE "CR"

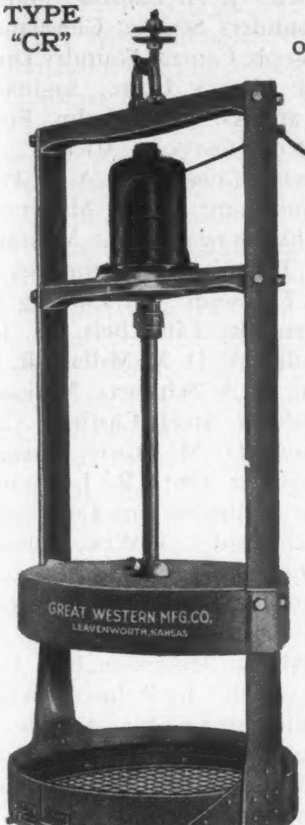
Over 10,000 Machines in Operation

OUR PRICES FOR COMPLETE MACHINES READY TO OPERATE

TYPE "V"—110 v. AC	$210.00
TYPE "CR"—110 v. AC	260.00
TYPE "CS"—110 v. AC	270.00
TYPE "V5"—220 v. AC	375.00

FOB Leavenworth, Kansas

TYPE "CS"



Type "CR"

FOR SCREENING . . . Moulding and Core Sands Medium Fine, Coarse Dry and Sticky Materials.

24" dia. Sieve is held in place by a perfected clamping device . . . . Sieve is easily removed, dumped and replaced in about five seconds . . . . This machine has a capacity of at least 20 men riddling by hand.

Special Vertical 1/3 H.P. geared head motor, totally enclosed, operates machine at about 287 R.P.M. . . . This slow motion, together with about 3" circle of gyration, thoroughly SIFTS, MIXES, AERATES and FLUFFS the sand . . . Dust-proof ball bearings are used . . . Height 5' 6" overall. Weight, 260 pounds.

Type "V"

FOR SCREENING . . . Moulding and Core Sands, Medium Fine and Coarse Dry Materials.

20" dia. Sieve is held in place by a perfected clamping device.

This permits removing and replacing sieve in about five seconds.

This machine has a capacity equal to 10 men riddling by hand.

Driven by a Special 1/6 H.P. totally enclosed motor equipped with ball bearings. Merely plug in on any light or power circuit.

5 feet high overall.

Weighs 100 pounds, making it possible for one man to carry it from place to place. Also made with 36" dia. Sieve, this being our type "V-5."

Type "CS"

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24" Square Sieve . . . Machine makes two separations . . . Screened material passes through the sieve and refuse tails off to one side . . . No need to dump sieves . . . Permits of continuous shoveling . . . Special vertical geared head motor, 1/3 H.P., totally enclosed, operates machine at approximately 287 R.P.M. . . . Has about 3" circle of gyration, which thoroughly SIFTS, MIXES, AERATES and FLUFFS the sand . . . Capacity equal to at least 20 men riddling by hand . . . Dust-proof ball bearings used . . . Height 5' 10" overall. Weight, 304 pounds.

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Rims are made of heavy steel. Bottoms of extra heavy Galvanized after woven wire cloth.

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GREAT WESTERN MFG. CO.

LEAVENWORTH, KANSAS

COMMITTEE MEMBERS APPOINTED
For General and Divisional Service

A NUMBER OF the many A.F.A. general interest and divisional committees contributing to the progress of the association and the industry are now completely staffed. Members, actively engaged in the foundry industry and allied trades, are giving freely of their time and experience so that all may benefit from their technical knowledge and skill.

A. M. Fulton, Northern Malleable Iron Co., St. Paul, Chairman, Malleable Division, has announced the following appointments:

Program and Papers—W. B. McFerrin, Electro Metallurgical Co., Detroit, *Chairman;* W. D. McMillan, International Harvester Co., Chicago, *Vice-Chairman;* R. P. Schauss, National Malleable & Steel Castings Co., Cicero, Ill., *Secretary;* A. J. Edgar, Benton Harbor Malleable Industries Inc., Benton Harbor, Mich.; J. H. Lansing, Malleable Founders Society, Cleveland; C. F. Joseph, Central Foundry Div., General Motors Corp., Saginaw, Mich., and G. Vennerholm, Ford Motor Co., Dearborn, Mich.

Executive Committee—A. M. Fulton, *Chairman;* W. B. McFerrin, *Vice-Chairman;* S. C. Massari, A.F.A. Technical Director, *Secretary;* C. F. Joseph; J. H. Lansing; C. F. Lauenstein, Link Belt Co., Indianapolis; W. D. McMillan; R. P. Schauss; H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland; D. M. Storie, Fittings Ltd., Oshawa, Ont.; R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., and L. J. Wise, Chicago Malleable Castings Co., Chicago.

Controlled Annealing Committee—R. P. Schauss, *Chairman;* J. A. Durr, Albion Malleable Iron Co., Albion, Mich.; Fred Jacobs, Lake City Malleable Co., Inc., Ashtabula, Ohio, and William Zeunik, National Malleable & Steel Castings Co., Indianapolis.

V. J. Sedlon, Master Pattern Co., Cleveland, *Chairman,* Patternmaking Div., announced the following:

Executive Committee—V. J. Sedlon, *Chairman;* A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, *Vice-Chairman;* H. F. Scobie, A.F.A. Educational Assistant, *Secretary;* F. C. Cech, Cleveland Trade School, Cleveland; J. W. Costello, American Hoist & Derrick Co., St. Paul; G. J. Gedeon, Aluminum Co. of America, Cleveland; E. T. Kindt, Kindt-Collins Co., Cleveland; Martin Rintz, Continental Foundry & Machine Co., East Chicago, Ind.; A. H. Stenzel, Stenzel Pattern Works, Houston, Texas; H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind., and L. F. Tucker, City Pattern & Foundry Co., Inc., South Bend, Ind.

Patternmaking Machinery and Methods Committee—J. W. Costello, *Chairman;* G. E. Garvey, City Pattern & Foundry Co., Inc., South Bend, Ind.; V. A. Miller, Acme Pattern Works, Elkhart, Ind.; J. J. Schallerer, Calumet Pattern Works, Chicago, and G. W. Schuller, Caterpillar tractor Co., Peoria, Ill.

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NAME COMMITTEE MEMBERS

(Continued from Page 182)

Dr. H. Ries, Chairman, Sand Division, has named the following:

Committee on Physical Properties of Iron Foundry Molding Materials at Elevated Temperatures—H. W. Dietert, Harry W. Dietert Co., Detroit, *Chairman;* G. F. Watson, American Brake Shoe Co., Mahwah, N. J., *Vice-Chairman;* W. A. Spindler, University of Michigan, Ann Arbor, *Secretary;* Roy W. Bennett, Metro-Nite Co., Hammond, Ind.; Robert Doelman, Miller & Co., Chicago; H. H. Fairfield, Harry W. Dietert Co., Detroit; J. A. Gitzen, Delta Oil Products Co., Milwaukee; John Grennan, University of Michigan; H. J. Jameson, Detroit Testing Laboratory, Detroit; R. W. Mason, International Nickel Co., Detroit; Eugene Passman, Frederic B. Stevens, Inc., Detroit; F. B. Rote, University of Michigan; Victor Rowell, Velsicol Corp.; Chicago; Arnold Satz, National Radiator Co., New Castle, Pa.; W. N. Seese, J. S. McCormick Co., Detroit; R. D. Walter, Werner G. Smith Co., Cleveland; and E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.

Committee on Physical Properties of Steel Foundry Sands at Elevated Temperatures—J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind., *Chairman;* Clyde B. Jenni, General Steel Castings Corp., Eddystone, Pa., *Vice-Chairman;* D. C. Williams, Cornell University, Ithaca, N. Y., *Secretary;* C. W. Briggs, Steel Founders Society of America, Cleveland; Werner Finster, Reading Steel Casting Div., American Chain & Cable Co., Reading, Pa.; H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.; P. E. Kyle, Cornell University; R. E. Morey, Naval Research Laboratory, Washington, D. C.; H. F. Taylor, Massachusetts Institute of Technology, Cambridge, and H. W. Dietert, Harry W. Dietert Co., Detroit.

Refractories Committee — Richard H. Stone, Vesuvius Crucible Co., Swissdale, Pa., *Chairman;* C. E. Bales, Ironton Fire Brick Co., Ironton, Ohio; J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala.; C. F. Joseph; A. S. Klopf, Western Foundry Co., Chicago, and R. H. Zoller, Zoller Casting Co., Bettsville, Ohio.

Heat Transfer Committee—H. A. Schwartz, *Chairman;* J. B. Caine, Sawbrook Steel Castings Co., Lockland, O.; H. F. Taylor; E. C. Troy, Dodge Steel Co., Philadelphia.

Deformation Committee—W. G. Parker, Elmira Foundry Co., Elmira, N. Y., *Chairman;* P. E. Kyle, *Vice-Chairman;* G. W. Anselman, Goebig Mineral Supply Co., Chicago; Robert Doelman; J. O. Ochsner, Crouse-Hinds Co., Syracuse.

Appointments to the Fluidity Testing Committee, announced by H. F. Taylor, *Chairman,* include: W. H. Baer, Naval Research Laboratory; C. W. Briggs; C. K. Donoho, American Cast Iron Pipe Co., Birmingham; R. A. Flinn, American Brake Shoe Co., Mahwah, N. J.; G. P. Halliwell, H. Kramer & Co., Chicago; C. E. Joseph; A. I. Krynitsky, National Bureau of Standards, Washington, D. C.; W. W. Levi, Lynchburg Foundry Co., Radford, Va.; O. H. Scheel, American Hammered Piston Ring Div., Koppers Co., Baltimore, Md., and N. A. Ziegler, Crane Co., Chicago.

PERSONALITIES

(Continued from page 150)

Metallurgical Engineers, a fellow of the Geological Society of America and a member of American Iron and Steel Institute, Cleveland Engineering Society and Mining and Metallurgical Society of America.

C. O. Worden, Jr., previously associated with Rustless Iron & Steel Div., ARMCO; Naval Research Laboratory and Glenn L. Martin Co., has joined Carl A. Zapffe Metallurgical Laboratory, Detroit, as an associate research metallurgist.

S. C. Wasson, manager, Melrose Park and Cicero, Ill., plants, National Malleable & Steel Castings Co., was elected a director of the company at the annual meeting of stockholders, March 27. Manager of the Chicago plants since 1943, he has spent his entire business career with the firm, starting with the purchasing department of the Indianapolis works in 1911 and advancing to works manager in 1929. Mr. Wasson is an A.F.A. National Director.

W. D. Woomer, machinist, Lynchburg Foundry Co., Lynchburg, Va., has received the President's Medal of the National Safety Council, an award in recognition of the actual saving of human life. Mr. Woomer successfully applied resuscitation to a fellow employe who had received a severe electric shock. A.F.A. Vice-President **Max Kuniansky,** vice-president, Lynchburg Foundry Co., presided at the colorful award ceremony. **H. E. McWane,** president of the safety council, made the presentation.

Elmer Schneider has been elected to the newly-created post of vice-president and director of engineering, Wheelco Instruments Co. Chicago. J. A. Reinhardt has been named plant manager.

J. C. Virden, chairman of the board John C. Virden Co., Cleveland, and **M. P. Winther,** president and general manager, Dynamic Corp., Kenosha, Wis., were named directors, Eaton Mfg. Co., Cleveland, at a recent meeting of the board.

R. D. T. Hollowell, for 20 years secretary-manager, Non-Ferrous Metal Institute, retired and was succeeded April 1 by **Isadore Glueck.** Prior to 1945, Mr. Glueck was associated with Federated Metals Div. American Smelting & Refining Co.

E. H. Dix, Jr., director of metallurgical research, Aluminum Co. of America, New Kensington, Pa., will be this year's recipient of the Francis J. Clamer medal for achievement in the field of metallurgy. The Franklin Institute of Philadelphia, made the award. The medal was voted Mr. Dix in recognition of his contributions to the development of high-strength, corrosion-resistant, aluminum products.

Obituaries

Harry W. Croft, chairman of the board and former president, Harbison-Walker Refractories Co., Pittsburgh, Pa., died February 25 in Greenwich, Conn. He was 81.

Native of Allegheny City, Pa., Mr. Croft entered the refractories field as a bookkeeper for Woodlawn Fire Brick Co., Woodlawn, Pa. That firm later merged with Harbison-Walker Co.

John Johnson, retired superintendent, Tarrant Foundry Co., Chicago, died recently at his home in Chicago. He came to the city 64 years ago from Scotland, and, at the time of his retirement, was superintendent of the foundry.

He was the father of **John Johnson,** present foundry superintendent of the Tarrant firm and an A.F.A. member with the Chicago chapter.

Edward F. Entwisle, general manager, Lackawanna, N. Y., works, Bethlehem Steel Co., died March 8 in Buffalo, N.Y.

Graduate of Cornell University, he joined Maryland Steel Co., Sparrows Point, Md., in 1914 as a mechanical engineer and, after Bethlehem acquired the firm in 1916, was transferred to Lebanon, Pa., as superintendent, ore concentrating and blast furnace operations. In 1928, he was named superintendent, Saucon Division, Bethlehem, Pa., and in 1936, general manager, Lackawanna works.

August Taylor, San Francisco, retired foundry executive, died March 15. He was at one time associated with his father, **W. H. Taylor,** in the Risdon Iron Works.

William J. Callister, who operated a foundry at Rochester, N. Y., died recently at the age of 91.

Convention Registration Fee

As in previous years, no Convention registration fee will be required of paid-up members of A.F.A. It should be pointed out, however, that all memberships in A.F.A. are held in the names of individuals. Therefore, a Company membership does not entitle all employes of that company to register at the 1947 Convention without payment of a registration fee.

By action of the A.F.A. Board of Directors on January 23, 1947, a registration fee of $2.00 will be charged each non-member desiring to register at the 1947 Convention and to attend the technical sessions.

ALL-CANADIAN

(Continued from page 143)

fineness numbers up to 70, and distributions over four or five screens. Mr. Kennedy emphasized the importance of mold density in its relation to metal penetration and at the same time noted that scabbing begins to appear in pockets when base sand fineness goes higher than 55 to 60. Discussion by the members pointed out that grain fineness numbers were secondary to grain distribution, particularly in mechanized foundries. Tooling and slicking a basically good sand usually results in increased scabbing and veining of that sand, Mr. Kennedy told the assemblage.

Brief mention was made of the necessity of tapering sections toward the feeders in order to eliminate center-line shrinkage. This point provoked interesting discussion on the possibilities of banishing center-line shrinkage by means of judicious use of proper foundry design together with more exact control of final pouring temperature as suggested by Mr. Hassel.

Limitation of time forced adjournment of the meeting before many points could be disposed of, but members agreed that a subsequent meeting should be arranged at which interested members would have an opportunity to complete the discussion.

Morning group sessions were divided into three sections, as follows: cast iron, Chairman, G. Ewing Tait, assistant manager of manufacturing, Dominion Engineering Works, Ltd., Montreal; non-ferrous, Chairman, Harold J. Roast, vice-president, Canadian Bronze Co., Ltd., Montreal; and steel, Chairman, Charles F. Pascoe, assistant general manager, Canadian Car & Foundry Co., Ltd., Montreal.

Afternoon sessions were divided into four groups: gray iron, Chairman, R. Williams, foundry superintendent, Canadian Westinghouse Co., Ltd., Hamilton, Ont.; steel, Chairman, Morris Holland, metallurgist, Fittings, Ltd., Oshawa, Ont.; malleable, Chairman, J. E. Rehder, metallurgist, physical metallurgy research laboratory, Department of Mines, Ottawa, Ont.; and non-ferrous, Co-Chairmen, Dave Sunnocks, chief metallurgist, Alu-

minum Co. of Canada, Ltd., Etobicoke, Ont., and G. O. Loach, sales engineer, Electro Metallurgical Co., Ltd., Welland, Ont.

The annual banquet was staged under the chairmanship of Henry Louette of Warden King, Ltd., Montreal, Chairman, Eastern Canada and Newfoundland chapter. The women present held their own banquet and theater party under the guidance of Mrs. Wotherspoon, wife of Jock Wotherspoon, Chairman, Ontario chapter.

H. T. Doran introduced an original song book containing parodies of popular tunes slanted for application to the foundry industry. The songs were enthusiastically received.

Many delegates to the conference visited well known Toronto and Hamilton foundries. Plants inspected included those of Aluminum Co. of Canada, Ltd., Toronto; Dominion Foundries and Steel, Ltd., Hamilton; Fittings, Ltd., Oshawa; Grinnell Company of Canada, Ltd., Toronto; Production Castings, Ltd., (division of John Inglis Co., Ltd.) Toronto; Standard Pattern, Toronto; Sully Foundry Division of Neptune Meters, Ltd., Long Branch, and A. H. Tallman Bronze Co., Ltd., Hamilton.

A.F.A. COMMITTEES

Job Evaluation and Time Study Committee—Robert J. Fisher, Falk Corp., Milwaukee, *Chairman;* M. E. Annich, American Brake Shoe Co., Mahwah, N. J.; W. E. George, Booz, Allen & Hamilton, Chicago; Harry Reitinger, Emerson Engineers, New York; M. T. Sell, Sterling Foundry Co., Wellington, Ohio; E. G. Tetzlaff, Pelton Steel Casting Co., Milwaukee; Dean Van Order, Burnside Steel Foundry Co., Chicago; Jeff Alan Westover, Westover Engineers, Milwaukee; and E. J. Williams, American Chain & Cable Co., Inc., New York.

Plant and Plant Equipment Committee—James Thomson, Continental Foundry & Machine Co., East Chicago, Ind., *Chairman;* H. B. Nye, New York Air Brake Co., Watertown, N. Y.; E. W. Beach, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., and W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa.

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